July

SIGNAL

1961

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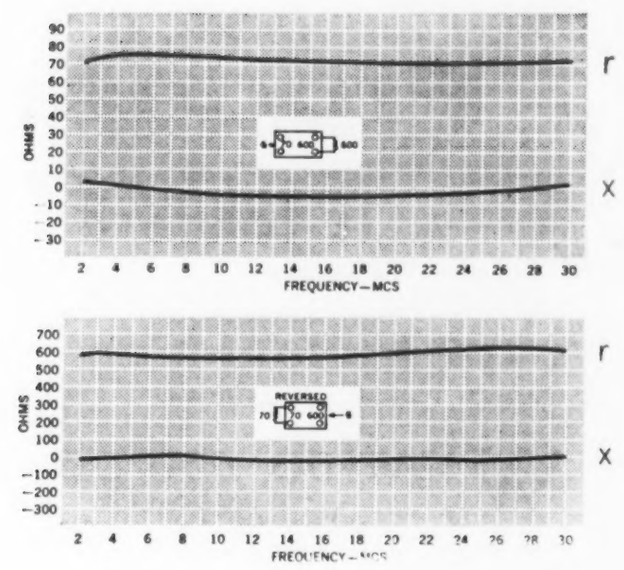

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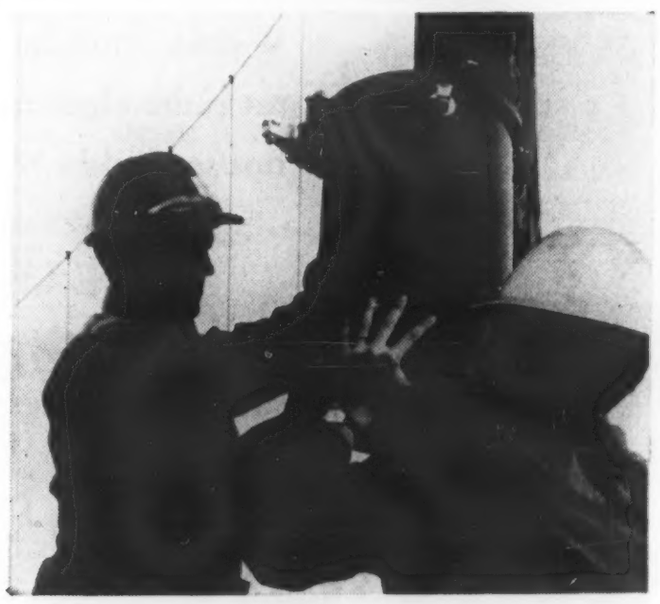

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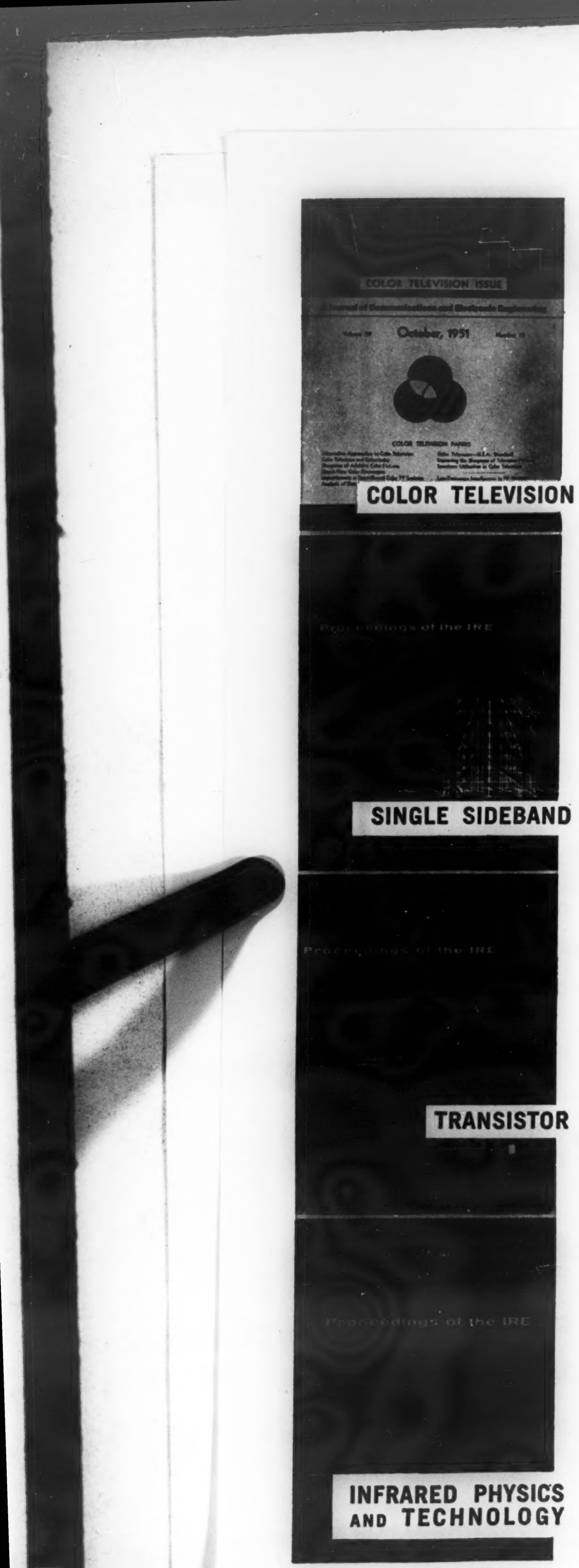

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Journal of the Armed Forces Communications and Electronics Association

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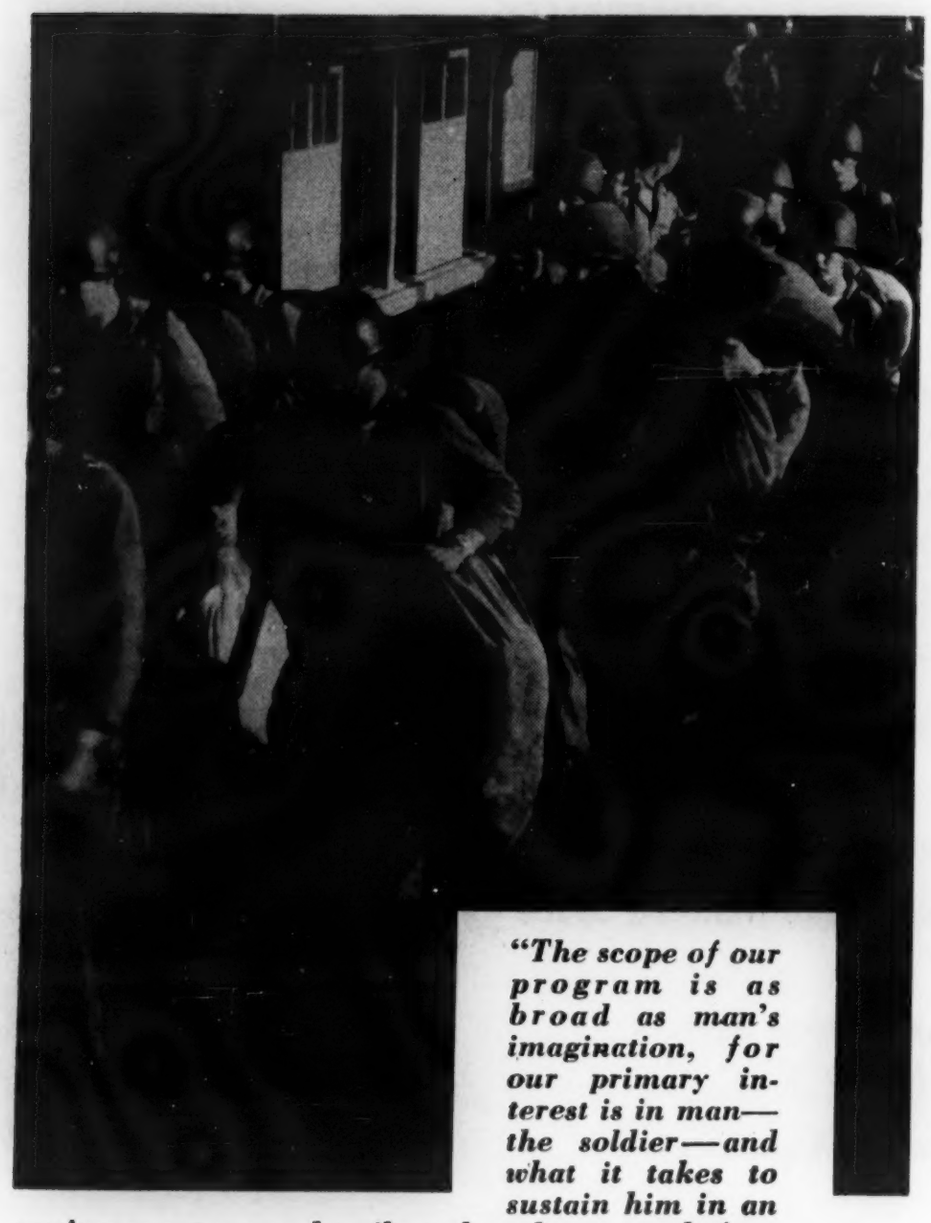
BPA

ARMY RESEARCH AND DEVELOPMENT PROGRESS

by LT. GEN. ARTHUR G. TRUDEAU, USA
Chief of Research and Development



"The scope of our program is as broad as man's imagination, for our primary interest is in man—the soldier—and what it takes to sustain him in an environment more hostile today than ever before in all history."

MODERN SCIENCE TODAY is less than 500 years old and technology is perhaps half of that—but in the last century—2 per cent of recorded time—mankind has achieved 90 per cent of his technological progress. And the future is even more challenging! Of all the men who have ever been trained in science and technology throughout the world over the 5,000 years of recorded history—on both sides of the Iron Curtain—it is estimated that nine-tenths of them are alive today.

One cannot reflect upon these startling facts without considering their impact on our world of tomorrow.

Today, in all the material aspects of our national life, the basis is shifting more and more to scientific research and its resultant products. Every great industrial firm knows by experience that, in order to maintain its position in the world market, it must engage in research and development—not only to improve old products and processes, but—more importantly—to develop new ones. The job of staying ahead of a competitor gets tougher each day in this fast-moving age of science and technology.

The Army, too, faces this challenge. We must look ahead to the demands of future battlefields. Like industry, planning ahead for competitive markets, we know that we must plan for those hostile scenes where the right goods, on the line, on time, mean the difference. The competition will be for life or death—the winner will take all—the loser lose everything.

The frontiers of science are fast cracking. Advances in radar, in electronic memory and computation devices, in television, in new power sources, in servo-mechanisms—and advances in a score of other fields promise to solve many of the serious, complex problems now facing us in the military.

Nuclear weapons have increased our need for greater mobility—far beyond what we have achieved today—and doubled our requirements for more accurate and speedy information. They have also accented the need for careful scientific assessment of targets before attack and immediate analysis of the results of fire. All of these new problems demand research and development of the highest order.

This one thing I know—science and technology can give us today just about anything we want. provided we know what it is, and are prepared to pay for it.

If yesterday's miracles are today's relics, what an age tomorrow will be—with science as our guide. We must have the vision and the determination to push science and its related technology forward from the base of our present achievements. We must strive ceaselessly for the unattainable—the ultimate in scientific progress.

Last December the Soviet government announced a 15 per cent increase in its outlays for scientific research in 1961. This will go for such important programs as blasting seven-ton cosmic vehicles into space and test firing long-range missiles from locations near the Caspian Sea into target areas more than 8,000 miles away. We must not view this Soviet challenge lightly—we must strive to surpass it—in quality and in quantity.

Now, I want to outline—insofar as possible—the dimensions of our R&D program and state our requirements as accurately as I can.

The Army Research and Development Program supports extensive investigations into basic research as well as into applied research and development. The scope of our program is as broad as man's imagination, for our primary interest is in man—the soldier—and what it takes to sustain him in an environment more hostile today than ever before in all history. My office, in monitoring this program, directs the efforts of approximately 40,000 civilian-military scientists, engineers, and supporting personnel who are concerned with some 400 projects and over 2,600 tasks.

Army Research and Development is a billion-dollar-a-year business.

Our efforts in basic research—to penetrate the ever-shifting boundaries of science—are extensive. We devote about $50,000,000 per year to this effort, expended through more than 550 laboratories, universities, and industries and 80 Army and other government installations. A small part of this research is conducted overseas in Japan and in 14 countries in Europe.

Today, basic research not only holds forth great promise of increasing our national prosperty, reshaping the routine of 180 million Americans, but it promises to give us in the military truly revolutionary improvements in the crucial fields of firepower, communications, and mobility.

The weapons and equipment of the past—and even of the present—provide no solutions for the future.

Happily, both the Wriston Commission and the President's Science Advisory Committee continue to stress the need to expand our national effort in basic research. In the Army we are continuing to get modest increases in the monies we are allotted for this research, and a fair segment of American industry consciously is expanding its effort in this critical area. Together, we must encourage this trend. Government, alone, cannot be responsible for, or do, the whole job in basic research. It cannot assume the entire cost of basic research in this country, now running about $1 billion a year. For the maximum in dynamic and realistic support, America must look to private enterprise, to industry, to our educational institutions, and to our scientific foundations for their contributions.

Now, let's look closer at basic research and highlight some of the prospects which promise a harvest of advanced weapons and equipment for the future.

Our military power today, in terms of firepower, is truly formidable. In communications—the *sine qua non* of command and control—we have leaped ahead. But the Army has one crying need today, and that is for revolutionary strides in the third vital area—mobility.

We must break the ground-bound barrier!

Lack of New Materials

Now, in mobility, imagination and engineering have outstripped existing materials and surpassed the state-of-the-art in power sources. I forecast that through new advances in the science of materials research we can cut through conventional barriers and attain the truly revolutionary improvement we require in mobility. Our progress here is dependent on the solution of crucial materials and energy problems.

For example, the lack of new and unique materials today is perhaps the most important single factor holding up the development of true air vehicles that will fly just above the "nap of the earth," permitting the combat soldier of tomorrow to overcome terrain obstacles, such as mud, swamps, ravines, rivers, and forests. This type of vehicle will have the take-off and landing characteristics of the helicopter, coupled with the advantages of the fixed-wing aircraft in forward flight—and will be able to fly—fast—*or* slow—*and* quietly—just above the battlefield.

The most pressing R&D programs are not in the field of development—but in research—in finding the new materials which can make creation of advanced military devices possible. The unprecedented demands for new materials in this area are staggering—materials, for example, that can withstand conditions of extreme heat and pressure in the order of one million pound per square inch and 5,000 degrees Centigrade. All the Armed Forces share the need, and are working jointly in this area on a variety of approaches—in plastics, in ceramics, in polymers, and in metals—spending several hundred million dollars a year.

It is important to point out that metallurgy is a field that has seen tremendous advances in the last ten years and can be expected to surge beyond the boundaries of our imagination in the next few. For example, it is estimated that within the next decade we shall have beryllium alloys with the strength of steel, but one-fourth the weight. Shortly thereafter will come plastics and ceramics with the same strength-weight characteristics. New steels with vastly improved characteristics are in sight now!

Ceramic Cutting Tool

Hardness is another characteristic we seek in new materials for structural use in high temperature engines, missiles and reactors.

For example let us consider one of our new ceramics—a research product of extreme hardness—the ceramic cutting tool.

Initially, it is in powder form before being molded into small cubes. Then, these ceramic powder cubes are inserted into a furnace where they are fused by baking into a solid state which is as hard as diamonds.

Fashioned into a lathe cutting tool, this ceramic will cut the hardest metals and at a rate many times faster than the conventional cutting tool.

Research efforts are also underway to bridge the gap between materials and solid state physics. Rich dividends, here, will permit us to chain-link large molecules so that materials—with properties we can hardly now imagine—can be created at our order. Instead of having to work with materials we have, we can have the materials we want. We can determine the ideal characteristics we need, then tailor them out of atoms and molecules as needed.

These and other materials research-sparked developments will rebound to the benefit of our civilian industry and commerce as well as to the military, giving us greater utilization of energy, increased measures of reliability and more efficient space accommodations.

How many of us in these days of wondrous advances remain impressed by the fact that electronic parts have been reduced in size in the last few years by modular concepts so that now instead of 7,000 parts per cubic foot, we can put 350,000 parts in the same space. Now, even this figure can be increased by a factor of ten in certain fuze applications, and using solid circuit techniques—or "molecular electronics"—even this is only a beginning. Just around the corner of tomorrow I predict we shall see a good wrist watch radio of the size of an after-dinner mint.

Advances in Miniaturization

To appreciate the progress made in the field of miniaturization, we have but to consider the reduction in four electronic circuits which can do the same thing—a large World War II-type vacuum tube, an early post-war transistorized assembly, a later miniaturized transistor assembly of the type found in hearing aid devices and finally the micro-miniaturized component, which is the 2-D tube, recently developed by the Army.

The relative size of these post-war developments can better be visualized if you consider how many of each we can put into a cubic inch of space. In a large transistorized circuit—15 parts per cubic inch; in a small hearing aid transistorized circuit—140 parts per cubic inch; and in the 2-D circuit—2,000 electronic components per cubic inch. Weight and power requirements are likewise reduced while reliability is vastly increased.

Even this is only the beginning as research progresses on solid circuit techniques.

New Energy Sources

To achieve true mobility in the air or on the ground—with almost noiseless operation—we need also to push forward basic research in the search for new energy sources. We must redouble our efforts to achieve new engines at less cost, with more economy, of less size and weight—and most importantly, with higher performance ratings under all kinds of conditions. Only at our peril, will we fail to investigate every new avenue that shows promise in the power spectrum—from today's gas turbine to tomorrow's fuel cell—from the magnetohydro-

dynamic generator to the solar cell—and in a future as awesome as it is near—nuclear power sources. Of these, the fuel cell now seems the most promising for the 1970's.

The fuel cell is an electrochemical device that produces electrical energy by direct chemical reaction. It has all the features of a battery except that the reactants—oxygen and some companion fuel like hydrogen—are supplied continuously and the products—carbon dioxide and water vapor—are removed continuously.

There are several commanding reasons for military interest in this cell. Significant is its potentially high efficiency compared with that of a gasoline motor—about 60-80 per cent compared with 25-30 per cent. This means more efficient utilization of fuel with substantial reduction in the logistical load. The fuel cell has no internal moving parts—no pistons, crankshaft, transmission and the like—and this means reduced maintenance. Of additional importance is the fact that fuel cells operate with an absence of noise or smoke, and generally without excessive heat. They therefore are harder to detect by the enemy on or above the battlefield.

Although the fuel cell promises some reduction in our supply requirements for fuels—in itself, the fuel cell is not the complete solution to our age-old logistics problem. One possible solution I see, in the 1970's, lies in the integration of the fuel cell—or groups of cells—with the nuclear reactor. The problem of providing propulsion fuel is then reduced to the task of converting the energy from a nuclear plant to a form which can be conveniently dispensed and utilized in vehicles of numerous types.

The optimum form—an integrated fuel-power system as an integral part of a vehicle—is speculative. Unfortunately, the extent to which nuclear plants can be miniaturized appears to be limited—and the cost of reactors is still too high. Yet, we can approach the optimum if we utilize a nuclear-powered, cross-country vehicle comparable to the overland train as a mobile supply point.

The several cars of the train would be equipped to manufacture certain chemicals, perhaps ammonia or hydrazine from water and air—and liquefy it for convenient storage and handling. The heat and power for the process equipment would be provided by the nuclear plant—which also would propel the train. The ammonia or hydrazine, in turn, would be furnished from this mobile service station to combat vehicles equipped with fuel-cell propulsion engines—or to stationary fuel cells providing electrical power for other applications. Such nuclear-powered energy depots could manufacture versatile chemical fuel locally within a combat theater and transport it near or to the place of use. We can foresee such a unit that could develop, within itself, the equivalent of 500,000 gallons of gasoline per day. With POL (petrol oil lubricants) constituting 40% of an Army's tonnage, the significance of such a development is apparent.

Integration of Sciences

In basic research, however, we are not exploiting the physical sciences at the expense of the life and social sciences. The requirement is ever increasing to blend knowledge of physical sciences together with that of the life sciences.

An example of this modern trend is the important research in cybernetics, in which the neurophysiologist, the mathematician and the electrical engineer blend their talents. Utilizing the latest developments in their respective skill areas, they are seeking to improve the state of medical knowledge.

Another is electric anesthesia—a major research advance the University of Mississippi Medical Center recently perfected under Army contract. This anesthesia promises to have considerable potential for surgery under combat conditions, as well as for civilian medicine.

The anesthesia is brought on by an electric oscillator providing 700 cycles of current (about 50 milliamperes at 25 volts) through an amplifier to electrodes attached to a patient's temples. The continuous impulses induce varying degrees of unconsciousness, under which surprisingly enough the patient feels no pain and upon awakening remembers nothing and does not suffer from the many after-effects commonly associated with the other anesthesias.

Our interest in medical research goes deeper. We are trying to understand better the functional characteristics of the human system so that analogs might be drawn in solution of complex problems such as plague us in the computer field.

Recent medical progress is also being integrated with gains in the field of materials research. The result is replacement parts for bodies damaged by accident or in combat. New hope of establishing better compatibility with life is thus being offered patients with major body defects. Thus far, only replacement parts for extremities have become common. Still needed are inert biologically acceptable materials to replace facial and body defects —as well as arteries and veins.

These are the kinds of breakthroughs in basic research —in the life, social and physical sciences—which are necessary to feed the insatiable appetite of applied research and development—for without new knowledge—without new science—applied research and development is limited to product improvement. Product improvement, important as it is, will not put us out in front, where we belong, or keep us there.

The following illustrates two of our latest Army developments. First there is the Goer—the vehicle which gives promise of true off-road mobility for transport of heavy cargo in combat areas.

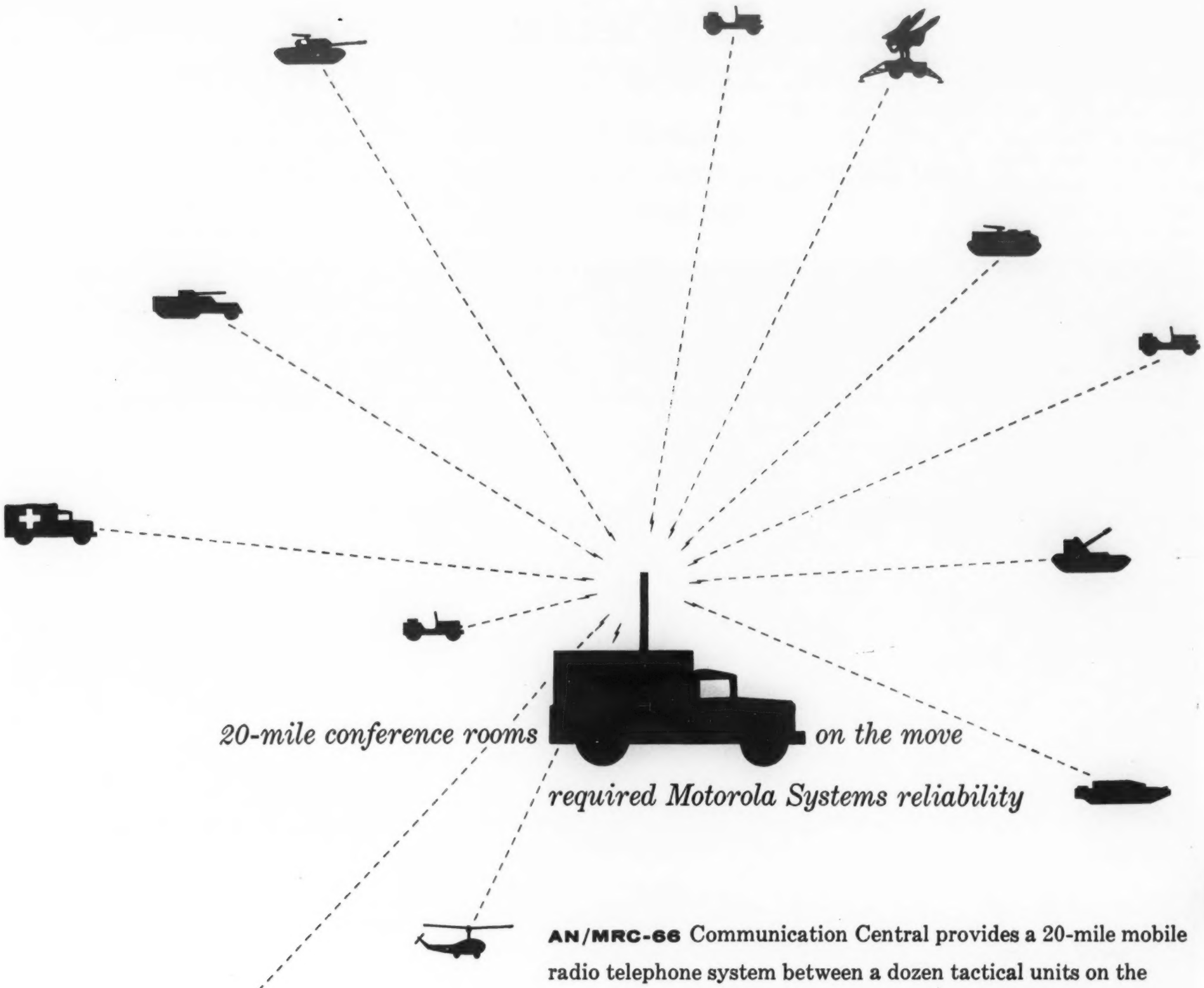
Secondly, let us consider briefly the Army's Nike Zeus, now in development. The Zeus can be loosed from its underground silo and attain supersonic speed quickly.

In action against an enemy ICBM, the Zeus radar picks up the ICBM target and the missile is guided toward the target. The course of the Zeus is determined by the computer data fed through the radars locked on both the enemy ICBM and the Army Zeus. The Zeus sustainer motor drops, and the nose cone with its deadly warhead now steers by a vectoring motor to home on the target. Triggered by a burst order, the Zeus kills the enemy missile.

I want to stress here that the 450,000-pound thrust Zeus booster engine is the most powerful single-unit, solid-propellant motor successfully fired in the Free World—and I feel there is an urgent requirement for such a defense weapon while we negotiate for peace. I am confident the Nike Zeus can do this job in the 1960's.

Now, I have covered the new frontiers of science and technology broadly and have given you but a flash insight to the future. Remember, it will only be for those with imagination—for those who dare!

In this age of surging progress, all Americans—and freedom-loving peoples throughout the world—must come to the realization that our collective security and progress depend as never before upon the imagination and boldness with which we acquire and utilize new scientific discoveries and industrial techniques for the progress and defense of our civilization and for the betterment of mankind. Here, we must sense new horizons—continuously—to meet the critical challenges ahead.



AN/MRC-66 Communication Central provides a 20-mile mobile radio telephone system between a dozen tactical units on the move... plus full compatibility with other radio and wire circuits. This advanced single sideband concept, developed by Motorola for U.S. Army Signal Corps, offers the transmission of simultaneous voice, teletype, facsimile and data transmission far superior to conventional modulation systems. SSB also allows more channels in a given portion of the crowded RF spectrum and more systems in a given area. ☆ Automatic Output Control insures uniform signal reception regardless of whether vehicles are deployed 100 feet or 10 miles from the Central. Three operating modes—Normal, In-Channel Net and Emergency Net—enhance the basic system flexibility. ☆ Simplification inherent in Motorola's concept and modular design affords the highest possible degree of reliability and maintainability in the field. Detailed information is available on request.

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WORLD-WIDE TELEVISION WITH ANISOTROPIC COMMUNICATION SATELLITES

by MAURICE G. CHATELAIN
Senior Research Engineer, Preliminary Design, Ryan Electronics Division
Ryan Aeronautical Company

THE HAZE FROM Mr. Dillon's smoking six-shooter could spread 'round the world in the next few years if America follows up the isotropic configuration of Echo I with other communication satellites of anisotropic design.

World-wide radio broadcasting, which includes television and FM radio, via orbiting artificial satellites appears to be the next great step in the art of communication if the anisotropic designs developed at Ryan Electronics prove as efficient in practice as they are in theory.

Television and FM broadcasting are limited to line-of-sight transmission. But Echo I proved that a radio beam can be bounced off a satellite, as dramatized by President Eisenhower's historic broadcast, Aug. 12, 1960.

It would be relatively simple to extend the limited range of TV-FM by reflecting the signal off a satellite and back to earth. With a series of orbiting satellites properly spaced so that any two consecutive vehicles were always within line of sight of each other, the signals could be bounced from satellite to satellite so that the listener could tune in the program of his choice anywhere in the world.

Echo's isotropic and spherical design makes it a low efficiency communication satellite, however, for the simple reason that only one small part of the huge metalized sphere's convex surface can transmit the signal to any one receiver. Since television transmission needs at least 1,000 times more power than conventional radio, the trick is to design a satellite with a reflectivity at least 1,000 times greater than Echo.

This can be done with anisotropic, or irregular surfaces, rather than the

ON THE COVER

Some of the satellites discussed in this article are pictured on the cover. They are identified below.

Top Row, Left: Checkerboard Satellite
Top Row, Middle: Concave Dodecahedron Satellite
Top Row, Right: Multi-Stripe Satellite
Second Row, Left: Convex Dodecahedron Satellite
Second Row, Middle: Dual Polarization Satellite
Second Row, Right: Multi-Spiral Satellite
Third Row, Left: Spherical Spiral Satellite
Third Row, Middle: Corner Reflector Satellite
Third Row, Right: Icosahexahedron Satellite
Bottom Row, Left: Multi-Dipole Satellite
Bottom Row, Middle: Multi-Cone Satellite
Bottom Row, Right: Multi-Helix Satellite

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isotropic, or spherical surface, of Echo. The remaining question seems to be which anisotropic design or designs will best do the job.

The advantages of relaying TV-FM signals by satellite are enormous. The frequency range, now 54 to 216 mc, could be increased to use the remaining portion of the VHF spectrum from 216 to 300 mc, plus UHF (300 to 3,000 mc) and microwave (3,000 to 20,000 mc). Since about six megacycles are necessary per channel, the higher we go on the spectrum, the more channels that are available per waveband. Too, a signal transmitted through space would meet none of the physical interference that now hampers broadcasting close to the earth's surface.

The first generation of communication satellites will be non-stabilized passive reflectors, and it apparently is generally assumed that, for a given size or weight, an isotropic metalized sphere such as Echo is the best solution. But for several reasons it now appears that anisotropic configurations should be better. Among those reasons:

1. A satellite is difficult to stabilize with respect to the earth, but it can be stabilized easily in relation to the earth's magnetic field so that, above any particular point on the earth, the satellite's polar axis always is oriented in the same direction.

Moreover, the maximum solid angle that can be subtended by the earth from a satellite is approximately 120 degrees, corresponding to an altitude of 600 miles. So, less than one-third of the satellite's surface can be used at the same time. But if the satellite attitude is known, the utilization of a directive reflector or antenna is possible.

2. Certain types of communication satellites do not have to be in operation all the time. By means of an automatic storing and gating device similar to that used in meteoric communications, transmission of information could be limited to those times when the satellite's attitude is optimum.

3. Even if the satellite must operate all the time and has no stabilization, it still can be designed in such a way that most of the energy intercepted is backscattered to the earth, thus reducing the transmitting power required.

There are numerous types of communication satellites, both active and passive, that can be realized in spherical and polyhedral configurations with much higher efficiency than the isotropic metalized sphere. Sample descriptions will explain why.

Spherical Anisotropic Satellites

In the checkerboard technique, the surface of the sphere is divided into a large number of equal areas alternately metalized and nonmetalized. For each nonmetalized area on one face of the sphere there is a corresponding metalized area on the opposite face. As a radio signal hits the sphere, part of the energy is reflected by the convex metalized area and part of the energy penetrates the nonmetalized areas to be reflected by the concave metalized areas on the opposite side of the sphere. The total energy of the signal that strikes the sphere is reflected, either backscattered by the outer convex surface or concentrated by the inner concave surface—with only half the weight of the metal used in Echo I. An important portion of the energy is thus reflected toward the earth.

In the dual polarization technique, the surface of the sphere also is divided into a large number of equal areas alternately covered with horizontal and vertical metallic stripes. For every horizontally striped area on one side of the sphere, there is a corresponding vertically striped area on the opposite side. With horizontally polarized radiation, for example, half of the incident energy is reflected by horizontal stripes on the front surface of the sphere, while the other half penetrates the sphere through the vertical stripes and is reflected by the horizontal stripes on the opposite side.

In the corner reflector technique, the sphere is divided into two hemispheres, one rotated 45 degrees with respect to the other, each hemisphere being made of four orthogonal corner reflectors. The incident energy is reflected in three different ways with one, two, or three successive reflections, depending upon the relative attitude of the satellite and direction of the incident beam.

In the multi-cone technique, the volume of the sphere is divided into a large number of concave conical reflectors whose apex angle determines the angle between incident and reflected beams. The same technique also can be used with concave pyramids instead of cones.

In the multi-lens technique, the volume of the sphere also is divided into a large number of conical volumes, the base of each cone being a dielectric lens of luneberg or conventional type. The incident beam is concentrated at the focus of the lens, reflected on a metallic surface, and retransmitted through the lens into a parallel beam either in the original direction or at a predetermined angle.

In the multi-stripe technique, the surface of the sphere is covered with oblique metalic stripes at 45 degrees of the sphere axis so that the stripes on one face of the sphere are orthogonal to the stripes on the opposite face. Since the satellite attitude is variable, the polarization of the transmitted beam is rotated until it is perpendicular to the metallic stripes on the front face. At that time, the beam penetrates the sphere, to be reflected by the opposite face acting as a concave spherical reflector.

In the multi-dipole technique, the sphere is covered with a large number of dipole arrays. In each array, the dipoles are alternately vertical and horizontally polarized, and so connected that the incident radiation can be retransmitted either in its original direction or that of any predetermined angle. This technique is particularly interesting in the case of private point-to-point communications where the distance between the two ground stations and the satellite altitude are constant.

Nonspherical Anisotropic Satellites

Those are a few examples of spherical anisotropic satellites. However, nonspherical configurations appear to offer certain advantages and should be considered, too. A polyhedron, for instance, has a very high directivity in certain directions. As an example, each face of a 30-meter diameter dodecahedron (twelve-faced vehicle)

has an effective area of 236 m^2, corresponding at 3 kmc to a directivity of 54 db—which is considerably more than that of Echo.

At least two techniques are available to improve a convex polyhedron so that most of the energy intercepted by its surface can be backscattered toward the earth. One technique consists of surrounding each face of the convex polyhedron with oblique walls. The other consists of replacing each face of the convex polyhedron with a concave pyramid.

Two regular polyhedra, the dodecahedron and the icosahedron (twenty-faced vehicle), are particularly convenient for the application of these techniques. There also is an irregular polyhedron that probably is even better. This is the icosahexahedron, made of 18 square faces and eight triangular faces. Each face can be surrounded with 135-degree oblique walls in such a way that not only the front face but also the surrounding oblique walls will reflect the total incident energy back to its original direction. The front face represents the short range reflector used, for example, in FM and television broadcasting in mountainous regions. The eight adjacent faces and their oblique walls reflect the energy at angles varying from 45 to 135 degrees with the incident beam and constitute the wide angle or long distance reflector used for world-wide commercial and military communications.

An alternative technique consists of replacing each face of a convex polyhedron with a concave pyramid. For example, the 12 faces of a dodecahedron or the 20 faces of an icosahedron can be replaced with 60 triangular faces. This type of polyhedron seems easier to manufacture and easier to inflate in space, and still represents considerable improvement over the isotropic sphere.

These passive satellites have been primarily developed for global communication at microwave frequencies. However, it seems they also will be used at optical frequencies. The recent development of a light amplifier, where incoherent green light is amplified and transformed into a very narrow beam of coherent red light, will make it possible to use light waves for global and space communications. At that time, very directive reflectors will be required and anisotropic passive satellites, similar to those just described, probably will be utilized.

Antennas Built on Sphere

In the near future, active, stabilized communication satellites will be realized. More directivity will be obtained from new antennas under development. Again, the best directive antennas seem to be those that can be built on a sphere, folded during launching through the atmosphere, and inflated in space. Based on the helix or spiral, these antennas can receive a radio signal from one direction and retransmit it in any other direction by means of a switching device.

The multi-helix antenna is a spherical array of conical helices and the metalized sphere constitutes the ground plane. These helices can be connected individually or by groups in order to obtain the required direction and beam width.

The multi-spiral antenna is a spherical array of spiral beam antennas, each of them made of a spiral director, spiral-driven element, and spiral reflector. Each spiral can be of the Archimedes or logarithmic type in order to obtain more directivity or more band width.

The spherical spiral antenna, developed in 1958 and now used for the Transit navigation satellite, also may be an excellent antenna for active communication satellites. It is composed essentially of a spiral conductor printed on the surface of a plastic sphere. The screw sense may be the same on both hemispheres, or it may be opposite in order to obtain a different polarization. It can be used as a dipole or as a slot antenna, and many different radiation patterns can be obtained by varying the screw sense of the spiral, the feed point phase, and the rotational position of one hemisphere with respect to the other.

Obviously, there are many anisotropic satellite configurations that should prove to be far more efficient than the isotropic design of Echo I. Echo's designers were resigned to the fact that its reflectivity would be low but anticipated that it also would be constant. Experience now shows that its reflectivity is highly variable, at microwave as well as at optical frequencies.

Studies completed at Ryan Electronics of anisotropic satellites indicate their reflectivity will still be variable, but tremendously higher than that of the Echo isotropic satellite.

A 200-foot communication satellite now is under development in the United States, and the scientific world will be waiting to see if this is merely a larger version of an experiment already tried—or if the opportunity will be used to test new and improved concepts.

AE is an old hand at developing specialized automatic communications devices and systems with unusual capabilities.

A typical example is the Automatic Line Insulation Routiner for the continuous, sequential testing of telephone lines. This unattended trouble-shooter tests lines for crosses, shorts and grounds—camps on a busy number until it is free—registers a fault by printing it on a paper tape roll!

Complex detailing and routining such as this are a logical extension of AE's long experience in the design of systems for dial telephone exchanges and military communications equipment.

If you have a tough problem in communications or control, AE can supply the answers—and provide the components or complete control systems to wrap it up. A letter or phone call (FIllmore 5-7111) to the Manager, Government Service Division, Automatic Electric Sales Corporation, Northlake, Illinois, will bring quick results.

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EDUCATION IN PUBLIC AFFAIRS: AN ESSENTIAL FOR SURVIVAL

by LT. GEN. GEORGE W. MUNDY, USAF
Commandant
Industrial College of the Armed Forces

IN THIS PAPER, I intend to stress the need for education in and an understanding of public affairs, i.e., vital issues of the day—and to do this both in our school systems and in adult educational programs.

In the school system itself, I am sure that you recognize the need for this. I have just a few thoughts that I would like to present. First, I think that we need to teach Communism in our schools—that is, its ideology, its double-talk, its perfidy, and its hostility to our own way of living. Our students should be able to distinguish between Communism and liberalism and idealism. Youth is certainly the time of life when one is most liberal in his views—and this is so in every country in the world. I recall once reading an article that described life as a slow stain; that is, as we grow older and accept more responsibilities, we sometimes compromise with principle, and this represents a stain on our character. The purpose of this article wasn't to indicate that there are no nice, old people. On the contrary, the purpose was to indicate that in the process of living, we lose some of our idealism and liberalism.

Now, there is nothing wrong with ideals and liberalism but our students should not be so uninformed on Communism that they could mistake it for liberalism, and thus be made the dupes of trained Communist agitators and propaganda specialists. This has occurred where these trained specialists have played on student emotions and caused them to riot against law and order. *Operation Abolition* is an example of this. There is a good deal of controversy over this film, but it seems to me the controversy stems from the feelings about the House Committee on Un-American Activities for the most part. There is also some controversy due to the fact that the shots taken by the movie and newsreel people are not in exact sequence. In all of the controversy, however, I have not heard anyone deny that they are authentic scenes that were taken by the newsmen at the time, and that these show the students rioting aginst law and order under the aegis of trained and known Communist leaders.

I believe that proper interest on the part of our students in public affairs is fostered by such things as school debates, seminars and other techniques that are well known by our educators.

Need for Education

The need for education in public affairs, in our schools and also at the adult public level has become crystal clear to me as a result of my three and one-half years experience as Commandant of the Industrial College of the Armed Forces.

Our country, in my opinion, is facing the greatest threat it has faced in its entire history since the dark days of Valley Forge. Certainly the situation is different today from anything that we have ever encountered in the past. In my opinion, if we are going to survive, we are going to have to understand the characteristics of this threat. In World War II we had Pearl Harbor to awaken us, to make it very clear that we were at war, and to crystallize public opinion to the necessity of winning that war.

Another Pearl Harbor, that is, an atomic onslaught on our homeland, might well be too late. Instead, we must recognize the threat that faces us, understand its characteristics, and take the necessary actions to coûnter it right now—if we are going to survive as a nation. This is particularly important since, under our form of democratic government the mandate of the citizens shapes the actions of the government. Thus if the government is to take the proper and decisive steps, the people must have a clear understanding of the issues involved.

Our experience at the Industrial College indicates that the people do have a thirst for knowledge, for a desire to understand what is going on in the world. But quite frequently the interpretations by the experts are too much at variance and often too technical to permit full understanding by the layman. In fact the very volume of material available on the nature of the present struggle tends to bewilder the public. Therefore, there appears to be a real need for an adult educational program in public affairs, a program to enable the citizens to understand the issues of the day. The citizen must understand the issues if democracy is to survive.

Volunteer Programs

It is encouraging to note that many business organizations, and civic and patriotic groups have been actively supporting the program of adult education through conferences, special study courses and seminars, on the problems of our national security. Our press is devoting increasing space to the problems confronting our nation. Colleges and universities have expanded their programs on both the

undergraduate and graduate levels. Philanthropic foundations are supporting institutes for the study of international relations. But as admirable as these measures are, they must be increased manifold if public understanding of the vital issues of our day is to keep pace with the rapid changes.

National Security Program

The Industrial College, within the limits of its resources, has endeavored to increase the understanding of public affairs and issues by the senior reservist of our military services and a cross-section of the civic leadership of the civilian communities. We do this through our National Security Seminar program which has been extremely well received and, I might add, it was just recently awarded the Freedom Foundation's George Washington Honor Medal for the outstanding results it has achieved. The National Security Seminars are two-week sessions presented by two teams of military faculty members of the Industrial College in some 14 cities throughout the country each year.

One has but to look at the headlines of recent months to get a picture of the complexities that face us. Civil war and Communist intervention in Laos — Khrushchev calls Hammerskjold a murderer and demands his ouster — United Nations forces attacked in the Congo — and so on. What is the real meaning of these news items? Are they reports of individual, unconnected happenings or do they form a single, over-all pattern?

As I have indicated earlier, a great deal of the answer lies in an understanding of Communism. At one time it might have been excusable to believe, as Winston Churchill said in 1939, that Communism is "a riddle wrapped in a mystery inside an enigma." But there is no excuse for misunderstanding their aims today.

The Communists have told us in their basic books and by their actions of their philosophy, their goals, their ideology, and their perfidy. Any intelligent man can translate their jargon or double talk if he will but take the time. In this connection, let me recommend a recent book, *The War Called Peace*, by Harry and Bonaro Oversteet. They are also the authors of *What We Must Know About Communism*.

I think that it is mandatory that not only our leaders, but our citizens as well, comprehend today's world with its dangers as well as its opportunities, and the necessity that we use all of our resources to combat a growing threat. This understanding must be furthered in the schools and colleges and among adult audiences. It has been said that we are living in a revolutionary era; this has been said so often that there is a great danger that we may become dulled to the truth of the statement. In my opinion, this is the greatest revolutionary era of history.

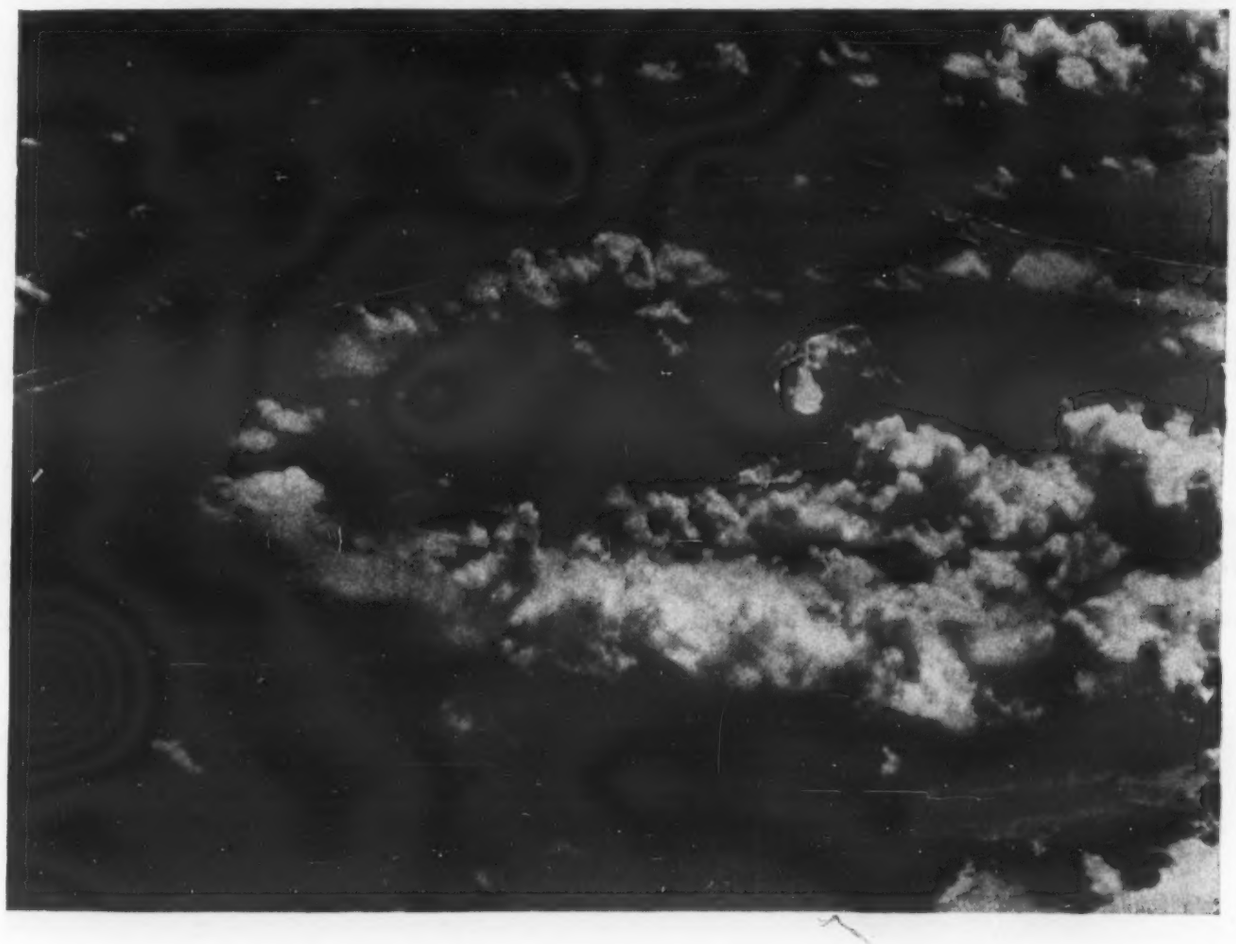
This is not an isolated power struggle. It is part of a tremendous upheaval that has been going on since the turn of the century and the changes that are being wrought are both profound and deep. Old forms of national and international existence are being replaced by a new order. Old colonial empires and old political alignments have literally vanished in the furnace of global war and in the light of new national aspirations. The changes in all the countries are penetrating to the very roots of society. Also the exploding world population is bringing about social pressures, since the economic systems in some parts of the world are not keeping up with the population increases. This upheaval in large measure has been accelerated by scientific discoveries and their technological applications, particularly in the fields of energy, communications and transportation.

The net effect of all this has been a shrinking of the world as we knew it. This shrinking has brought about a requirement for a high degree of cooperation or for some kind of a supranational federation. Certainly, a high degree of interdependence in all matters—military, political and economic—is a result. No nation is any longer self-sufficient unto itself, and this applies equally to the United States and to the U.S.S.R.

This revolutionary era has created many problems by itself. But the fact that international Communism exists adds greatly to the dangers because international Communism seeks to play upon and to exploit our problems for the purpose of furthering its goals of world domination. Yet at the same time, the Communist threat should provide the glue or incentive to the Free World to stick together, to take certain courses of action to survive. In fact, the big question of our day is just simply this: Will the future world, that is, the emerging world order, be in our image, the image of the Western World, or will it be in the image of world Communism?

To survive, I repeat, *we must understand Communism,* which has been hostile to our way of life since its very beginning over 100 years ago, and whose goal is still world domination. Its ideology is intellectually dishonest as anyone who studies it can readily discover. Its philosophy is at variance with every major value that we cherish. So what we really have is two civilizations in conflict.

The present Communist line is peaceful co-existence—but the words do not mean what they seem to. It is competitive or peaceful as long as we do our end of the competing, and let me assure you that if we fail, we are through. So to prevail in this situation, we must recognize it for what it is—all-out competition—and we also must have the intention to prevail. No amount of wishful thinking or semantics will remove the threat that we face. (*To p.* 15)



The pilot is inside, flying over enemy lines.

The SD-1 Surveillance Drone flies remotely controlled tactical surveillance missions without risking manned aircraft or pilot. It is extremely mobile, simple to use and maintain, and can be readily adapted to carry TV or film cameras, infrared, radiation detection or radar reconnaissance equipment. The SD-1 is the Army's only operational surveillance drone. Northrop's Radioplane Division developed and produces it.

RADIOPLANE
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But what can we do to get on the ball? What should our strategy be, what should our programs be? I would like to repeat again that first of all we must appreciate the totality and the nature of this conflict; we must have inspired and dedicated leadership coupled with understanding and support at the grass-root level. And we certainly must expose Communism for its falseness. But this exposure in itself is not enough. We must also rededicate ourselves to our values, to our system of individual freedom under law, for ours has been the real revolution. The leaders of the newly emerging countries, and of those areas still seeking independence look to our Declaration of Independence and to our Constitution for their example. They quote the words of our founding fathers and not those of Marx, Engels, Lenin, or any of the other Communist leaders. Ours has been the real revolution—the revolution based on the inalienable rights of man and of the principle that the state is created to serve the citizen. We also have to be more articulate on these values to the world.

Our citizens must recognize that political freedom can be sustained only by continuing individual effort. It is impossible for us to buy our freedom. Each generation coming along must earn and deserve its freedom.

Continuing with what we must do in view of the threat we face, when we negotiate with Communism we must, as the President said at Inauguration, do so from a position of strength. We must know the value of the chips and we can't forsake principles for expediency's sake. In these negotiations, we should certainly attempt to seek armament limitations or armament controls, but it has to be done realistically; we cannot afford to let it be one-sided. It is absolutely necessary that we make an all-out effort in this area because, as you probably know, the atomic know-how or atomic club will be gaining new members in the foreseeable future, therefore we must arrive at some realistic armament controls program soon.

We also have got to remain strong (and the President covered this in his Inauguration), militarily, ready for any contingency—and take the necessary actions to assure this strength. But I would like to emphasize that we also must have strong nonmilitary programs, for together, nonmilitary programs and military programs make national power and we can't make any distinctions between them today.

I think that some of the best proof of the lack of adequate conprehension of the danger on the part of our citizens, lies in the almost total absence of programs to survive an atomic attack and to recover. We just don't have any realistic programs in spite of all the good work that has been done by the Office of Civil and Defense Mobilization.

Now what are the facts here? Are people apathetic, plain bored with it, or do they believe that nothing can be done?

Possibility of Attack

The Rockefeller Report says that we cannot discount the possibility of an atomic attack. Therefore, ordinary prudence dictates that we prepare to the extent possible. Our people are in error when they believe that it is a hopeless situation, that nothing can be done about it. The situation is not hopeless. The Rand Corporation, for example, has made a study which indicates that we can, with proper action, defend ourselves and recover within a reasonable period of time.

Now I would like to emphasize that this program to survive and recover must be bigger than the "hole in the ground" approach some people seem to think about. Certainly, fall-out shelters are extremely important; but so is the stockpiling of food and medicine; and so are provisions for law and order, continuity of authority, controls, money, early resumption of manufacturing and the many other programs that are part of a total survival recovery program. Failure to have a realistic program could result in the reduction of our national power position. When we are faced by a potential adversary who has a long range delivery capability of atomic weapons in conjunction with a civil defense program, and we have no such program, we stand the danger of limiting the free exercise of our foreign policy and the free employment of our military strength. The results could subject us to atomic blackmail and bring about the deterioration of our national power.

I would also like to point out that a civil defense program is something the government cannot do in its entirety. The government's program will be large, for it must plan, it must lead, it must subsidize to a degree. But the real burden here is on the people. They have to know that it can be done, and that it should be done—and I am sure that if our people comprehend the need—it will be done. The very doing of the program by the people themselves, particularly the individual shelter part of it, will serve to improve the moral fiber and the national character, since the people will be doing something to help themselves.

Continuing with our broad strategy, military strength is very expensive and it is growing more so as our weapon systems grow more sophisticated. Also the cost of our research and development program is great and is increasing—but it is a necessary ingredient if we are going to stay ahead. We can't overlook the possibility of a technological breakthrough by our opponents. Our exploration of space is a must for many reasons. There are prestige values, there are military reasons for being out in space, there is the profit of increased knowledge, there are the advantages that accrue from strong research and development space programs that have a commercial advantage. The cost of meeting these military research and development programs is large but these costs must be met and in a manner that will not undermine our economy. This is one of the thorniest problems in Washington, as you know.

The preservation of our economy is a must; it is a keystone of our national strength and we are fortunate to have an economy of such size and diversity that it can meet all the requirements that can be placed on it if we but give this economy prudent management.

The Cold War

Let us assume that we have been able to deter any military action of significance by having a force-in-being, by having a research and development program and a survival and a recovery program, and we do all these things without inflicting unfavorable damage on our economy. I see another very grave danger that we are facing and one that is little understood—the cold war, and particularly its economic phase. I think that this phase emphasizes more than any other the totality of the threat that we are facing. It is an area where our people don't comprehend our opportunities or the necessity for our participation. The necessity is rerelated to the fact that hunger anywhere is a challenge to prosperity and security everywhere. This is so because hunger breeds chaotic conditions, conditions that make nations ripe for revolution and Communism.

Private capital has been called the neglected weapon of the cold war. It is also the only weapon that we have in our arsenal that the Communists don't have. Private capital is going to be needed and in large amounts,

(*Continued on page* 32)

AERIAL SURVEY breakthrough

SIGNAL REPORT

A technological advance in map-making technique

ANALYTIC AERO-TRIANGULATION, a new procedure for controlling aerial photographs more rigidly to permit better map compilation, has been accomplished by scientists of the Coast and Geodetic Survey, U. S. Department of Commerce. The procedure promises to make aerial surveys three to four times more accurate than at present.

It is believed this is the first time a complete mathematical system with extremely high standards of accuracy has been accomplished by any mapping agency in the world. The principle of the system has been known since the birth of photogrammetry, but what is new is the application of complex mathematical equations, precise photogrammetric instruments and high speed electronic computers into practical and workable procedures.

In recent tests of photographs taken at 20,000 feet and using the new interpretative system, errors in positions and elevations were reduced from the normal 10 to 12 feet to approximately 3 feet in actual ground measurement. Aside from the obvious advantage of greater accuracy, the new system also has an economic advantage because the photographs can be taken at a much higher altitude requiring fewer photographs.

An important part of the new system is a precise instrument known as the comparator. It measures positions on the aerial photographs to the nearest micron (1/25,000 of an inch or about one-hundredth of the width of a human hair). The measured readings are transmitted to an electronic "read-out" instrument for review by the operator and simultaneously recorded on a perforated tape. The tape is fed into a machine which converts the data to IBM punch cards. It is at this point that electronic computers take over and through the unique application of existing equations the correct positions and elevations are computed from the data. Contemporary methods require that measurements be made on a complex optical-mechanical analog instrument, after which the data must be computed.

Both the analytic method and the analog instrument attempt to recreate, as nearly as possible, the conditions that existed at the moment the photograph was taken. The analytic method does this mathematically, however, narrowing the chance of mechanical error.

Several innovations were incorporated in the new method to improve the accuracy. A special new plastic is used as a base for aerial film, which is printed on glass to prevent deformations. Selected "control positions" on the photographs are marked with very fine drill holes in the surface emulsion, under stereo vision.

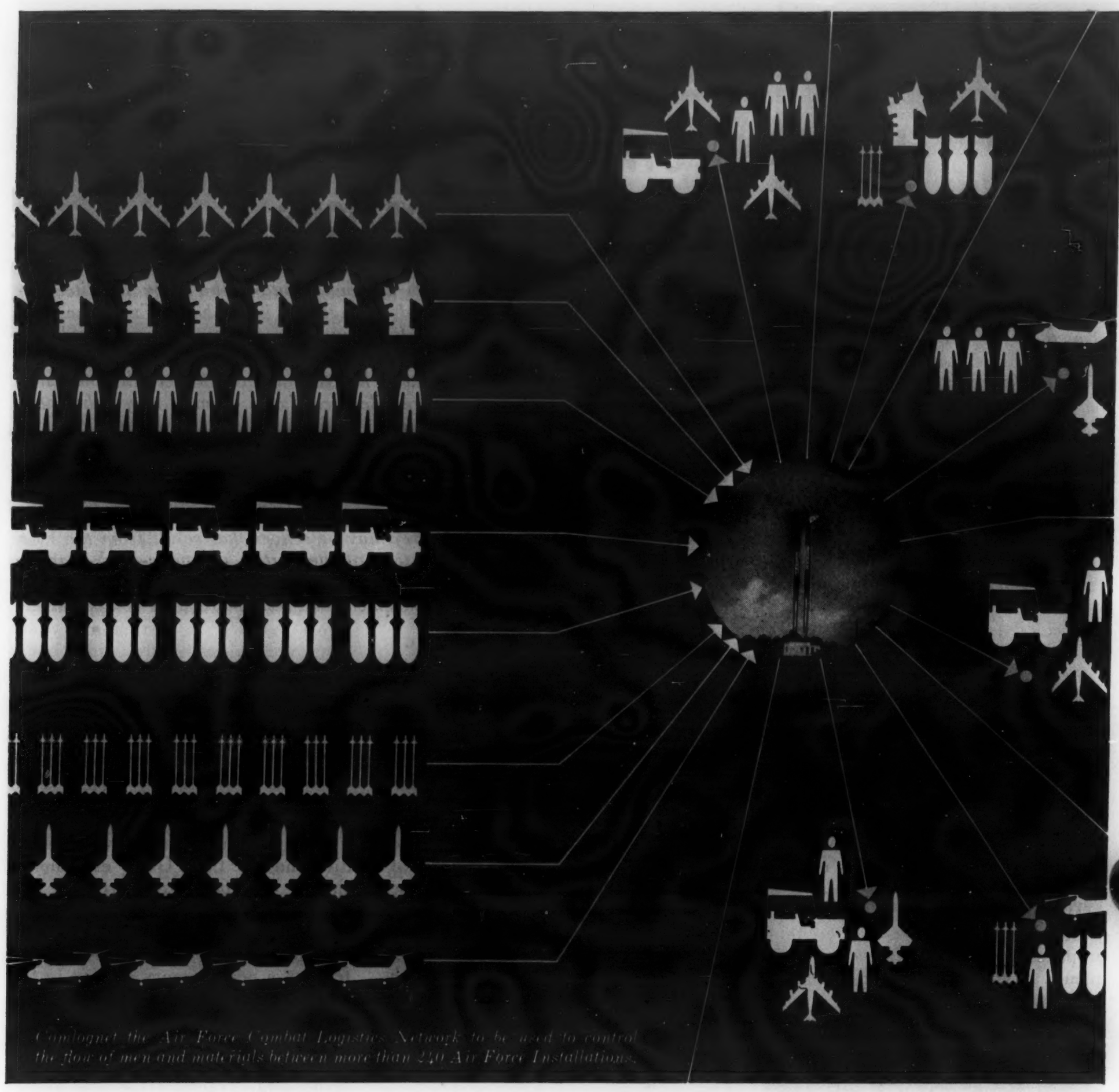
The comparator is a monocular instrument as opposed to the stereoscopic analog instrument. Its great sensitivity requires a constant room temperature of about 70°F. It will detect the minute distortions allied to aerial photographic work, such as film distortion, lens distortion, atmospheric refraction and earth curvature, and measure the amount of error. It provides source data which is reduced to positions and elevations by an electronic computer.

For testing the analytic aero-triangulation method, a series of aerial photographs were taken of the Shenandoah Valley, south of Staunton, Virginia, at an altitude of 20,000 feet. Thirteen of these exposures were selected which represented an area 4 miles wide and 27 miles in length. Position and elevation errors of test points were found correct within three feet. For this test the control points were marked clearly with signal cloth in the field before the photographs were taken, to provide clear identification on the photographic prints.

The Coast and Geodetic Survey plans to use the new photomapping method for improving, expediting and economizing in its various mapping programs. Tests will be continued to improve the accuracy still further and to make an exhaustive reliability determination, officials said. A simultaneous solution of two or more adjoining strips of photographs is now being programmed.

"The photogrammetric work of the Survey makes a significant contribution in support of the commerce and industry of the Nation," Secretary of Commerce Luther H. Hodges stated. "Large-scale topographic and planimetric maps are used effectively in planning and developing various commercial enterprises in coastal areas such as factories, plants, laboratories, docking facilities and other installations."

The equipment and new techniques are available to industry at reasonable cost and are economically feasible to adopt by private surveying organizations.



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This instantaneous communications and data network has the capability of handling every known form of electronic communications swiftly, accurately, and automatically. Upon completion in 1962, Comlognet will have a daily capacity of seven million punched cards in its five U.S. centers, making it the world's largest data processing system. Future expansion, including the handling of data from overseas installations, will be readily accommodated.

Modernization of Comlognet is another first for the U.S. Air Force and Western Union. Acting as prime contractor, Western Union designed and engineered this electronic network in participation with other companies.

WESTERN UNION...*finds better ways to speed it electronically*

by RADM. FRANK VIRDEN, USN
Assistant Chief of Naval Operations (Communications)/Director, Naval Communications

LOFTI AND OTHER NEW DIMENSIONS IN WIRELESS COMMUNICATIONS

Editor's Note: *By receiving VLF (Very Low Frequency) radio signals from a ground station, the Navy satellite provided science with its first data on the degree of VLF penetration into and through the ionosphere. From the data telemetered back to earth from the satellite, Naval Research Laboratory scientists have been able to confirm their belief that the ionosphere is not nearly as opaque at these frequencies as generally assumed and that VLF radio waves do pass through the ionosphere into the exosphere with relatively little attenuation. It has thus been definitely demonstrated that while the ionosphere reflects VLF radio waves back to earth to a large degree, it also permits very substantial penetration of VLF waves to outer space.*

The data from the satellite also indicates that unlike higher frequency radio waves, which travel through the ionosphere at essentially the speed of light in free space, the velocity of the VLF waves is dependent on the geometry of the signal path and local ionospheric conditions, and is a fraction of the speed of light. In addition, under certain conditions, weaker pulses that seem to be delayed replicas of the preceding signal pulses appear in the output of the satellite VLF receiver. These secondary pulses are delayed as much as ⅔ second; they may be echoes that result from the VLF waves emitted by the ground transmitter being guided along the configuration of the earth's magnetic field, starting from the northern hemisphere and travelling to the southern hemisphere, then being reflected back. The long time delay of the echo is an indication, in part, that the guided waves traverse the ionosphere and exosphere with comparatively low velocity.

SINCE THE FIRST WORD of the title of this paper is LOFTI, meaning Very Low Frequency Trans-ionospheric (we couldn't pronounce it clearly with a V in front and LOFTI sounded very appropriate for a satellite anyway), let me see if I can present a short, clear picture of the why, what, how, and whence of this unique experiment.

The purpose of LOFTI I, the first of the LOFTI series, was to obtain propagation data on Very Low Frequency signals in the ionosphere, which was a subject of wide uncertainty. It was a modest experiment in which a 20 inch sphere carried a 57 pound payload. It had a loop antenna and also 15 foot dipole antennas which were supposed to extend to each side. LOFTI I was to hitch-hike aboard a Transit all-weather navigation satellite, and be cast loose in a 400 mile high orbit. It would then listen for VLF signals on 18 kilocycles from our station NBA in the Canal Zone and telemeter them back to earth at a Very High Frequency of about 137 megacycles.

Launched February 21, 1961, the two satellites went into a highly elliptical orbit, and for six weeks thereafter dipped around the earth to gether from the bottom to the top of the ionosphere.

As such things too often turn out, this dizzy ride of Transit and LOFTI resulted in a foreshortened existence, ending in a flaming re-entry 38 days after launch. This was most undesirable from the standpoint of Transit, which was expected to outlive most of us and our great grandchildren, but from the LOFTI point of view it put us well ahead of schedule. Despite the fact that the dipole antennas could not extend, data have been collected on the propagation of VLF and various other effects from top to bottom of the ionosphere instead of just at the 400 mile level. It will be many weeks before these data are all reduced and evaluated, but the primary fact, that VLF can be used successfully for communications through the ionosphere has been established at least in the earth to space direction.

Space to Submarine Transmission

Now the problem is to develop the capability to transmit VLF from space to submarines and other assorted customers down below. Any one familiar with the size of shore based Very Low Frequency stations realizes that it will tax the ingenuity even of the brilliant gentlemen at the Naval Research Laboratory who designed LOFTI to put together a VLF transmitter package small enough to place in orbit. Not that I have the slightest doubt they will do it someday. It is on the program. However, it must be emphasized that in the present basic research stage of communications satellites and with our great dependence on powerful Very Low Frequency Communications for highly reliable long range transmission under the most adverse conditions, it would be a little wild eyed to jump to the conclusion that an operating solution to all VLF problems has been achieved. All we have done is to impart some important new dynamics and a new dimension to a hitherto conventional art.

Our pleasure over the unexpected dividends of the LOFTI experiment should not totally obscure the fact that Transit was also a partial success. The primary objective of Transit, designated III B in the series, was to test out a new memory storage in the satellite and evaluate the effects modulation of the Transit carrier would have on the doppler signals employed for navigation. From an engineering standpoint, Transit III B was a success in that the chosen concepts for storage and modulation were proven valid and provided reliable performance throughout the life of the satellite.

New dimensions in wireless communications are not limited to Very Low Frequency. This is very fortunate for the Navy for we are essentially a wireless outfit so far as our operating forces are concerned. But realization has dawned upon us that shipboard wireless has not kept up with the demands of the times. We have been somewhat too conservative in our evolution, until now we are almost forced to put an R on the front of that word. The revolution of our shipboard wireless is now in its early stages.

A Navy exists for the protection of the nation through the exercise of

its seapower. Seapower in its naval manifestation is made up of the ability to operate with the utmost responsiveness, versatility and flexibility, alone or in combination with others, anywhere on earth that a ship can go or a ship-based aircraft can fly, and to deliver the message of humanity, or friendship, or force, of the quality and quantity needed, and at the place and time needed. The more seapower can be exercised by and among mobile forces themselves instead of resorting to multitudes of shore bases, the nearer we move toward a true naval seapower concept. We have given much thought to gains we obtain in survivability by increasing the mobility of our seapower. Communications plays an increasingly important role in this.

An example of where we are going in wireless communications to tie in with the mobility concept has been publicized recently in releases of Congressional testimony about USS *Northampton*. *Northampton* was originally configured as a Fleet Command Ship which evolved from a combination of the World War II Amphibious Command ships, and some Royal Navy ideas on double decked combat information centers aboard ship. *Northampton* has been in a process of evolution from the time she was commissioned, and is still evolving. Aboard her we are now able to communicate by plan with nearly any U. S. or allied forces, ship or shore based, directly in many cases, and via relay in others no matter where they may be. We make extensive use of multichannel single sideband teletype, single sideband voice, UHF airborne automatic voice relay, and so far a jury-rigged trans-horizon scatter form of communications to ensure the maintenance of reliable high quality communications during the troublesome morning and evening transition period and during adverse weather and solar conditions. Low Frequency Communications from *Northampton* have been in use successfully from time to time, and will be in use in the future. Facsimile is available in *Northhampton*, and we can remote key Very Low Frequency be it shore based, ship based, airborne, or in orbit.

Satellite relay communications are not yet contemplated for *Northampton*, but *Northampton* is, we hope, only the first of a line. Our shipboard satellite communications program is being developed in conjunction with the Army's Advent program. When developed, it will be applicable to communications via Moon Relay and other passive or active systems. It is obviously not ready for *Northampton*, but we are optimistic that we will not have to wait for it too long.

A principal distinguishing feature of modern wireless communications for command and control must be, in my own phrase, a telephone man's point of view toward the transmission path, and all the appurtenances thereto. A telephone call from a ship was always a rather difficult matter until we began to use direct pick up and talk line of sight equipments at the beginning of World War II. These relatively simple devices, combined with that wondrous new creation called radar, gave us the most flexible tactical capabilities you can think of, and certainly deserve a vast share of the credit for the success of the Pacific Ocean Area Campaigns. These ship-to-ship telephone-like facilities were normally limited in range to the dimensions of a carrier task force, an amphibious task force or two or more task forces operating in mutual support.

Communications Responsibilities

Now we are faced with the need for the same kind of extremely close coordination and quick response on a world wide scale, without benefit of over-all radar presentations. Communications must provide the complete picture for everything outside of radar range. Tactical time values must be obtained at ranges which once permitted considerable transmission delays. Evaluation and decision making, now increasingly weighty and requiring time for deliberation, must not be encumbered in the execution by slow communications. Every wireless mode must be available to the Commander, suited to the distance and the path conditions, directly transmitted or automatically relayed through other mobile or fixed stations. All of this channel and route selection process must be automatic and the Commander should be cheerfully oblivious to it. All he should have to do is to pick up the phone, or dial, or pass a written message to the communications office as the situation demands.

I have barely scratched the surface of a subject that is becoming a real thriller in modern communications. When I wrote on this subject 19 months ago, (SIGNAL, Dec. 1959) it with with a little vision, a little hope, and fingers crossed. Today, I can say that the vision is becoming more and more real, the hopes are stronger, and with the help and interest of science and industry we can expect great gains in the future.

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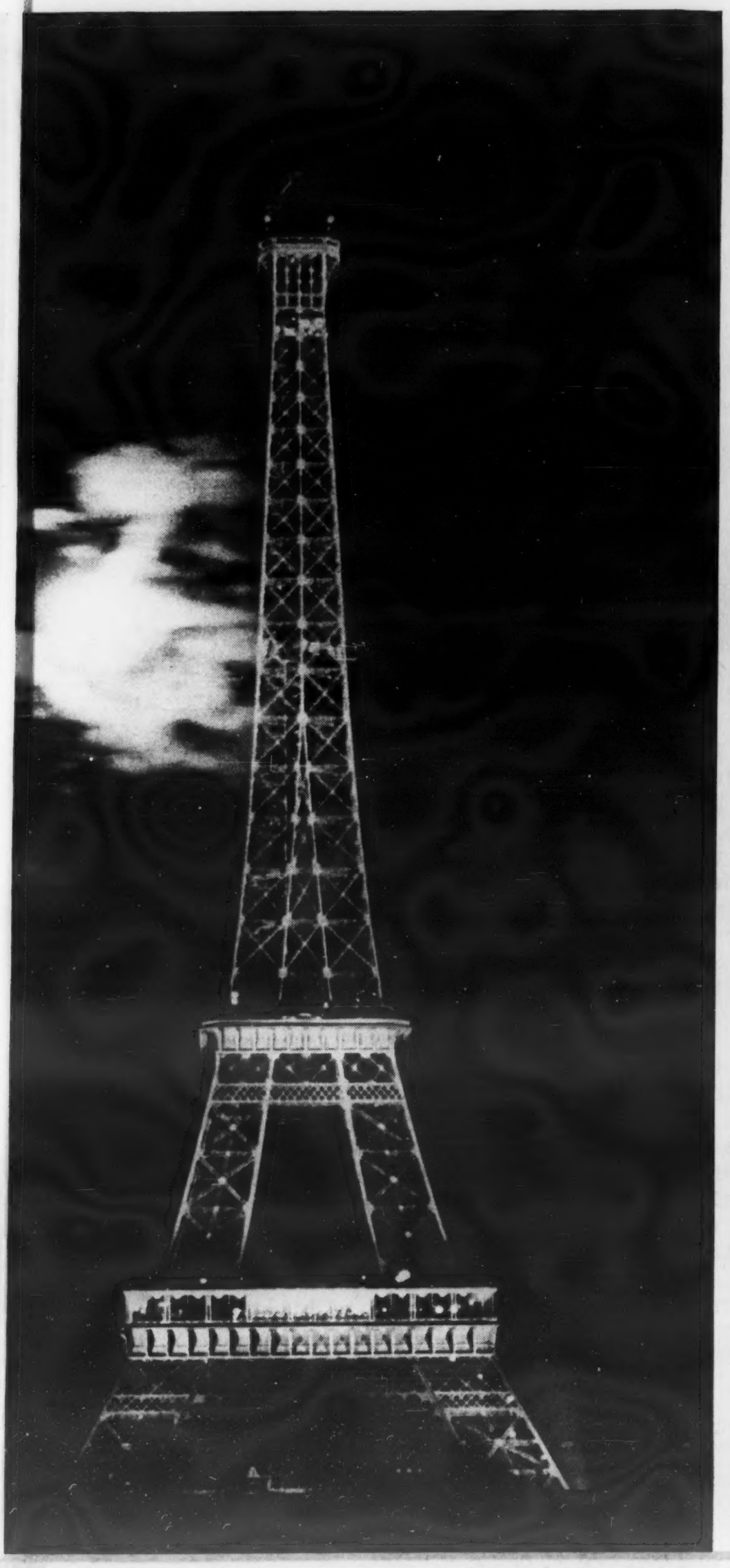

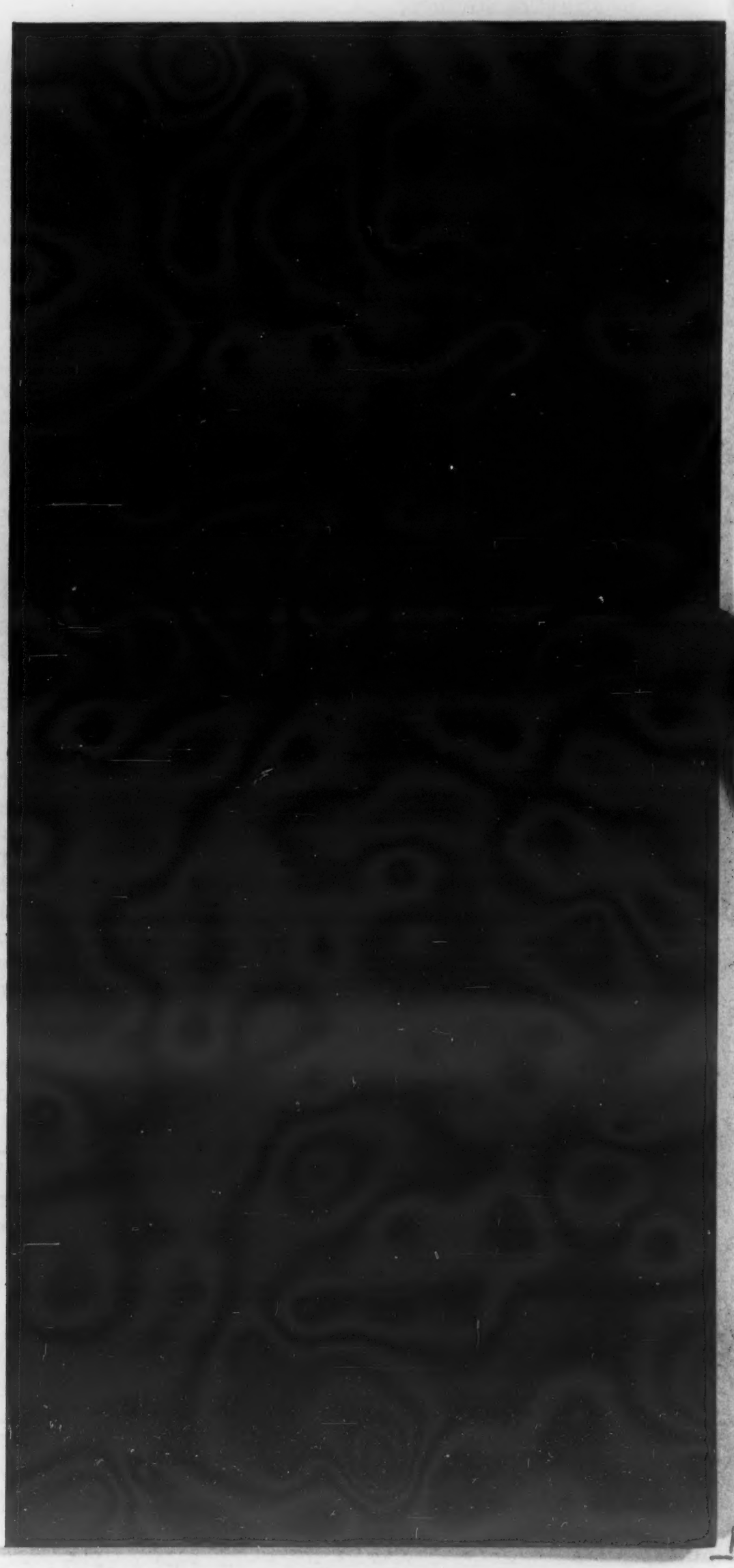

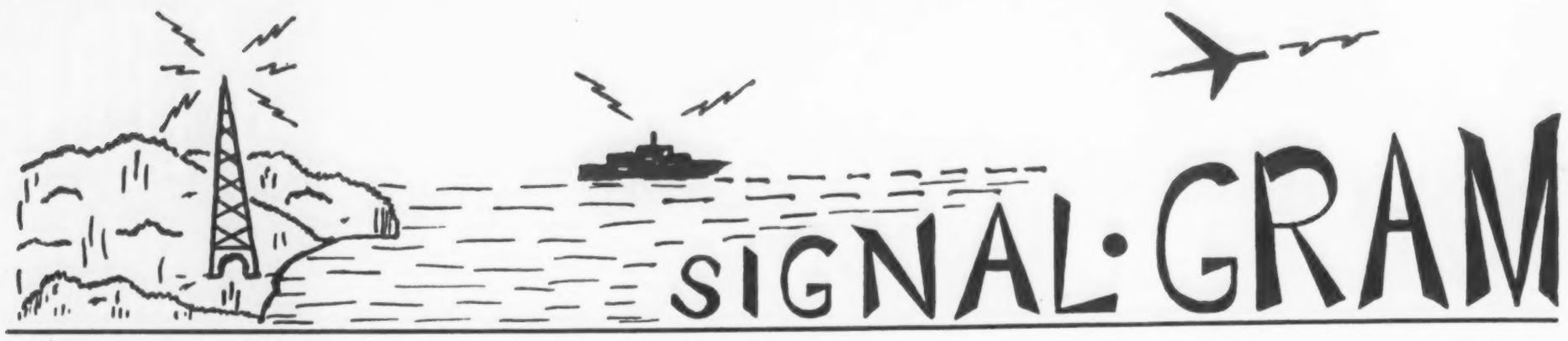

—GOVERNMENT—

NETWORK OF EARTHQUAKE RECORDING STATIONS will provide data on the nature, location and frequency of world earthquakes that might ultimately lead to prediction of destructive shocks. The world-wide network will be instrumented by the Coast and Geodetic Survey, it was announced by Secretary of Commerce Luther H. Hodges. With financial support of the Advanced Research Projects Agency, Coast and Geodetic Survey technicians will be sent to 65 countries and islands to install modern seismic equipment at 125 existing earthquake recording stations. The network is one part of ARPA's Project Vela-Uniform, the national program of research in seismic phenomena. Equipment for the network is being supplied by The Geotechnical Corp.

FCC CONFERENCE FOR INTERNATIONAL COMMON CARRIERS was held last month for the purpose of exploring plans and procedures looking toward the early establishment of an operable commercial satellite communications system. The Federal Communications Commission believes that some form of joint venture by the international common carriers should be established for such a communications system. Ownership of the system should be limited to the international common carriers, the Commission thinks.

DAMAGE ASSESSMENT CENTER CONTRACTS totaling $5½ million have been awarded to three firms by the Defense Atomic Support Agency, the Defense Dept. has announced. The Center, scheduled to be operational this month as a part of the DASA, will provide special information and damage assessments in fractions of seconds, permitting vital decisions of nuclear warfare to be made rapidly. The contracts were let to the System Development Corp. for computer model development and programming; Control Data Corp. for computer system; and Ramo-Wooldridge Division of Thompson-Ramo-Wooldridge Corp. for display system.

NAVY CONTRACTS TO SMALL BUSINESS FIRMS accounted for 95.7 percent of the Navy's Bureau of Yards and Docks contracts during three quarters of fiscal year 1961. In classifying small business firms, the Navy quoted the Small Business Administration definition of a small business in the construction industry as one, which, with its affiliates, has averaged annual receipts of $5 million or less for the past 3 years.

MORE THOR ROCKETS are being made available to the Air Force for use as boosters in United States space programs. The Air Force has ordered twenty-two DM-21 Thor rockets from the Douglas Aircraft Co. The DM-21 model has a shorter, lighter airframe than earlier versions and has a more powerful 165,000 pound thrust engine. Earlier engines produced 150,000 pounds of thrust. The new vehicles are slated for additional Air Force Discoverer firings, the Navy's Transit Navigation satellite program, the National Aeronautics and Space Administration's Nimbus meteorological satellite program and other projects. Thor also has been selected by NASA to boost its polar-orbiting geophysical observatory satellite. In the past two years the Thor rocket has been the chief booster for the majority of United States civilian and military space programs.

DEFENSE LIMITED WARFARE SYSTEMS OFFICE has been established by the Director of Defense Research and Engineering, Dr. Harold Brown. The new office combines the functions of the former Assistant Directors for Naval Weapons and Tactical Weapons. Over-all responsibilities of the new office include activities in the fields of sea combat, antisubmarine warfare, fleet air defense, amphibious and land combat, mobility, logistics, guerrilla, counter-guerrilla and tactical warfare systems, and related phases of tactical warfare. Frank A. Parker, formerly serving as Assistant Director of Naval Weapons, has been named to head the new office.

THOMAS A. EDISON POLARIS SUB was launched at Groton, Conn. June 15. Built by General Dynamics Corporation's Electric Boat Div., the FBM submarine will carry A-2 missiles, which have a range of 1500 nautical miles.

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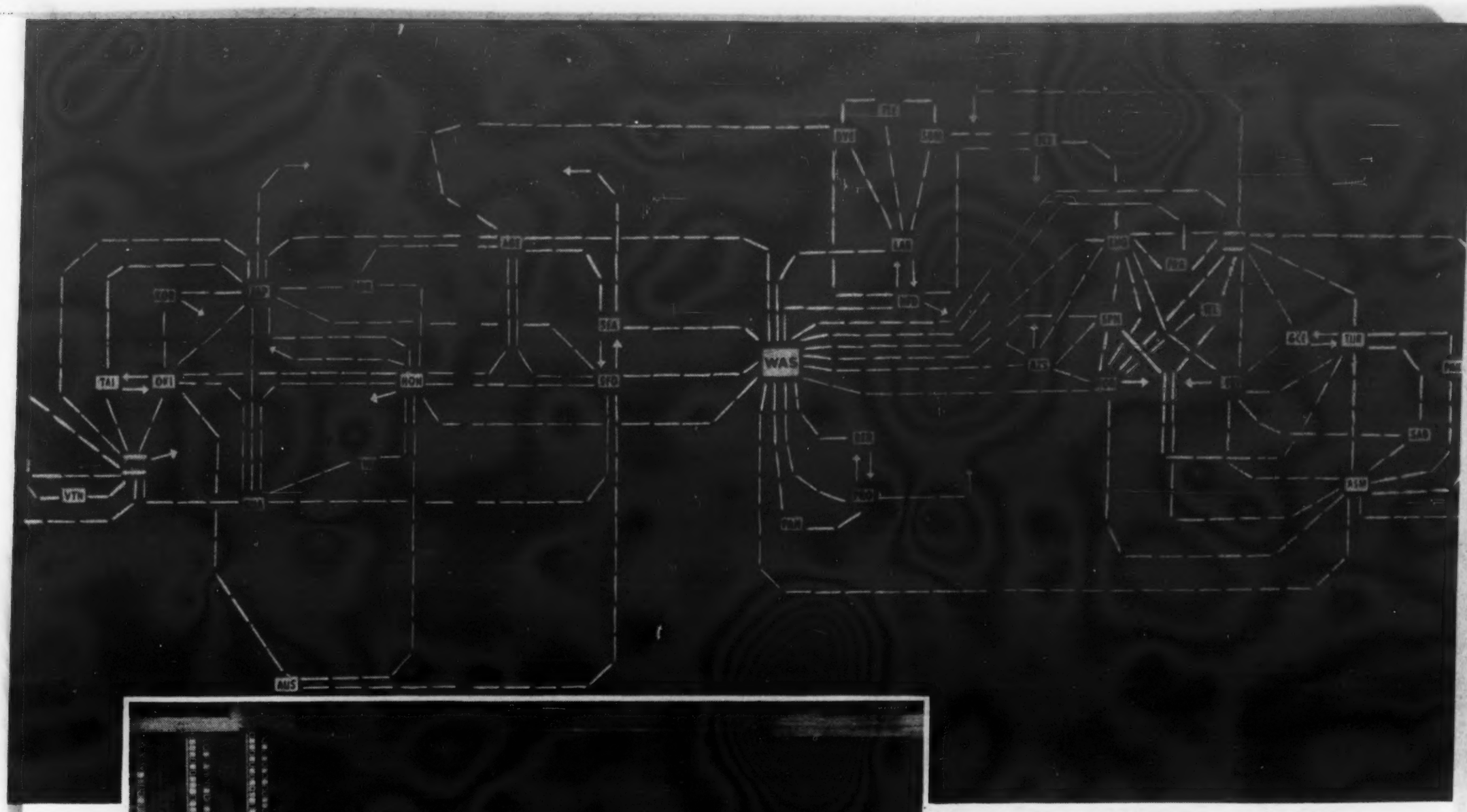

The Defense National Communications Control Center by Philco

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The Control Center is constantly supplied with the current world-wide status information by stations operated by the Army, Navy and Air Force. This information is processed by the Center, where the status of the entire world-wide system is displayed in order that control can be exercised. When a breakdown or overload occurs anywhere in the system, communications are restored and vital information is quickly re-routed through alternate channels.

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SATURN LAUNCH SITE has been completed at Cape Canaveral where early Saturn space vehicles will be fired, reports the National Aeronautics and Space Administration. It is the largest known rocket launching site in the world, NASA states, and the first such base built especially for the peaceful exploration of space. From this site the first Saturn heavy space vehicle will be fired in an experimental flight to test the booster propulsion system later this year. This will be the beginning of a series of large rocket test flights which is expected to lead, by 1965, to the launching of tons of instruments to the moon and Mars, and early versions of the three-man Apollo spacecraft which will ultimately be used for manned lunar landings.

ACCELERATED RECRUITING AT NASA has been ordered to fill existing vacancies and to anticipate manpower requirements of an expanded space exploration program. NASA has authorized its field centers to step-up hiring of qualified scientists and engineers. Recruiting teams will interview individuals who are about to graduate from colleges and universities as well as recent graduates and experienced engineers and scientists.

STATUS OF DOFL FUEL CELL PROGRAM is contained in the first summary report of the Diamond Ordnance Fuze Laboratory program, released to science and industry through the Office of Technical Services, Business and Defense Services Administration, Commerce Dept. The purpose of the program is to develop a technology that will make practicable use of fuel cells as a prime source of power to propel ordnance vehicles, the report states. The general approach to the project has been to explore the use of hydrocarbon fuels, directly or indirectly, in fuel cells. At present, there is no clear choice between a direct or indirect electrode for either the anodic or cathodic side of the cell, according to the report. (Order PB 171 050 from OTS, Commerce Dept., Wash. 25, D. C., 50 cents.)

LARC CALCULATOR will be used in research tests on nuclear reactors at the Applied Mathematics Laboratory of the Navy's David Taylor Model Basin, it was announced during ceremonies dedicating the calculator system at DTMB. LARC (Large Automatic Research Calculator) system makes feasible the simulation of the lifetime behavior of mathematical models and the calculation in hours of the performance of the various components during the power producing life of the reactor core. Different reactor designs can be studied by the LARC and the most efficient design for a specific purpose selected. This procedure reduces the need for pilot model construction which sometimes takes years.

CUTLER VLF STATION was dedicated June 23. Rear Admiral Frank Virden, USN, Director of Naval Communications, was the principal speaker for the dedication ceremonies of the $70 million station in Maine. With an output in excess of 2,000,000 watts, the new station will provide transmission to all units of the fleet in the North Atlantic, Arctic Ocean, and the Mediterranean waters.

GROUND-BREAKING CEREMONY for the new laboratories of the National Bureau of Standards at Gaithersburg, Md., was held June 14. The ceremony signals the initial construction phase of a 20-building, $104 million program to completely relocate NBS from north-west Washington to a 555-acre site in Montgomery County.

CONTRACTS: ARMY: Bendix Corp., Bendix Systems Div., design, development and fabrication of airborne down-range missile measuring equipment, $1.7 million; Sylvania Electric Products Inc., Waltham Laboratories, construction of ground stations for Advent communications satellite program, $1.2 million. NAVY: Sperry Gyroscope Co., production of automatic missile-guidance radar systems, $33.4 million; North American Aviation, Inc., Autonetics Div., production of Ship's Inertial Navigation Systems for nine Polaris submarines of Lafayette class, $21 million. AIR Force: General Instrument Corp., construction of transportable microwave radio communication sets, AN/TRC-66 (V), $4 million; General Precision, Inc. modification of RADAN Doppler navigational equipment used on B-52 Stratofortress.

— INDUSTRY —

NINE COMPANIES in the communication and aerospace industry have been contacted for discussions leading toward a joint venture to establish a commercial communication satellite system, according to Communication Satellites, Inc., a newly organized company which will act as a focal point for the proposed cooperative participation by private enterprise in a world-wide commercial communication satellite system. Firms contacted include American Telephone & Telegraph Co., General Telehone & Electronics Corp., Hawaiian Teephone Co., International Telephone & Telegraph Corp., Lockheed Aircraft Corp., Press Wireless, Inc., Radio Corporation of America, and Western Union Telegraph Co.

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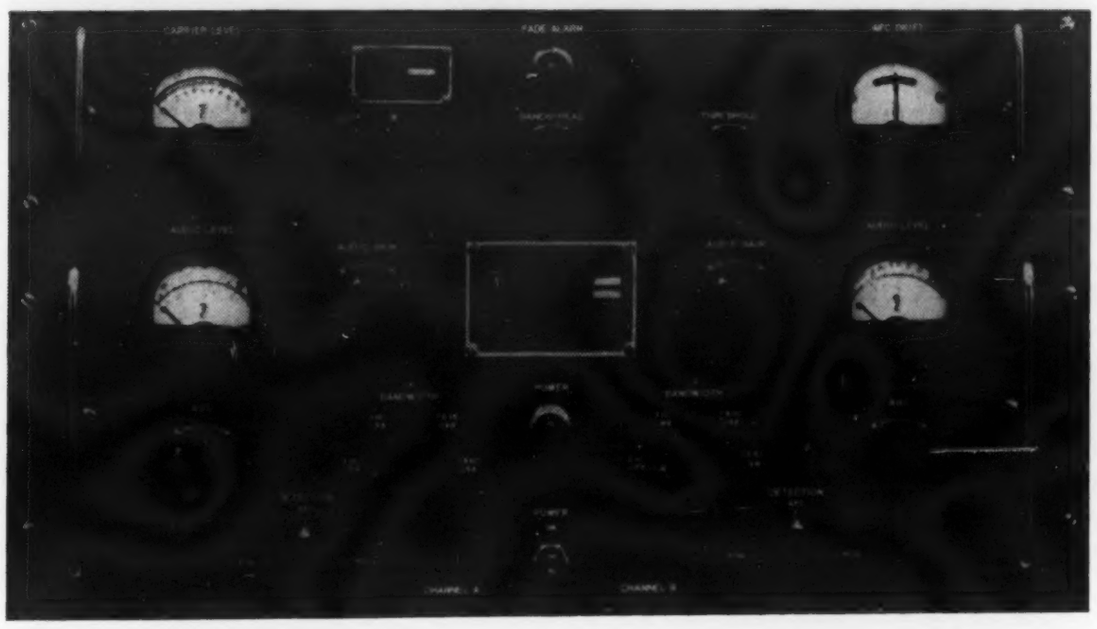

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HOFFMAN ELECTRONICS CORP. will provide solar power supplies for a forthcoming series of Navy's Transit navigational satellite experiments, under a $185,000 contract from the Applied Physics Laboratory of The Johns Hopkins University. The firm will manufacture the high-efficiency solar cells for the space beacons and will provide one half of the required satellite power panel assemblies.

EIA COMMITTEE has been established to assist the Defense Dept. and other federal agencies in understanding management and technical problems affecting the electronic component parts industry, it was announced at the Electronic Industries Association's annual convention in Chicago recently. The Government Liaison Committee, which has been formed within EIA's Parts Division, will develop a paper outlining management problems foreseen as resulting from implementation of the Darnell Report on Parts Specification Management for Reliability. The committee also will establish contact with the Armed Services Electro-Standards Agency and EIA groups representing the association before government agencies.

RADIO CORPORATION OF AMERICA will construct the Relay experimental communications satellite to test the feasibility of transoceanic telephone, telegraph and television communications using an active repeater satellite. The RCA proposal was selected from seven proposals submitted to the National Aeronautics and Space Administration's Goddard Space Flight Center. The Goddard Center will negotiate and manage the contract, which will amount to about $3.2 million. Relay is the first active satellite in NASA's research and development program to explore the technology of global communications satellite systems. The Relay satellite will weigh about 100 pounds and will be placed in an orbit extending outward to about 3,000 miles. A Delta launch vehicle will be used.

LONG-RANGE, HEIGHT-FINDING RADAR for use on missile cruisers and carriers of the Navy will be produced by General Electric Company's Heavy Military Electronics Dept. under a $36 million contract. Scheduled for delivery to the Navy in May 1962, the AN/SPS-30 radar is designed to increase the anti-air warfare capability of the fleet and will replace the GE-built AN/SPS-8 radars now in use aboard many of the Navy's combat ships. The AN/SPS-30, employing a mechanically stabilized antenna to compensate for roll and pitch of the ship, is capable of simultaneously determining direction, range and height of multiple airborne targets with extreme accuracy, G.E. says.

BULOVA TIMER IN EXPLORER XI successfully performed the "switch-over" process in which the satellite's transmitter stopped sending back reports on its own tumbling flight through space and now is broadcasting data about cosmic effects on itself, according to Bulova Watch Co., Inc. The tiny electronic timing device developed by Bulova, called Accutron, was pre-set to permit broadcasts to be made about the first experiment for just one month. Explorer XI was launched April 27 from Cape Canaveral by the National Aeronautics and Space Administration. Officials have not yet been able to determine exactly when the switch-over took place, but know that the timer caused the change some time May 26 or May 27. According to NASA, the important point is that the feasibility of switching transmission from one experiment to another at a pre-set time, after a long time delay, has been proven.

CARRIER CORP. will develop a thermoelectric air conditioner which will be suitable for operational testing aboard a nuclear submarine or a suface ship, the company said. Being developed under a Navy contract, the new unit is intended to serve as a prototype for the development of a complete shipboard air conditioning system that would require no compressors, boilers or other mechanical cooling and heating equipment. The prototype will be designed for installation in air ducts serving one section of the vessel in place of conventional air cooling and heating equipment. In a complete system, additional units of the same type would be installed in other areas of the vessel where air conditioning is needed.

AEROJET GENERAL AND WESTINGHOUSE have been selected for contract negotiations for the development of the NERVA (Nuclear Engine for Rocket Vehicle Application) nuclear rocket engine, the Atomic Energy Commission and the National Aeronautics and Space Administration have announced. Aerojet General Corp. and Westinghouse Electric Corp. were two of the seven companies that submitted proposals to the joint AEC-NASA Space Nuclear Propulsion Office on April 3, 1961, in response to the invitation for proposals issued on Feb. 2, 1961. NERVA is part of Project Rover, a joint AEC-NASA program for the development of a nuclear rocket propulsion system. The reactor to be used in NERVA will be a follow-on to prototype reactors under development at the Los Alamos Scientific Laboratory. The first of a series of Kiwi-B experimental reactors is scheduled to be ground tested in the fall at the AEC's Nevada Test Site.

REPUBLIC AVIATION CORP. will develop an all-weather airborne reconnaissance and battlefield surveillance system for use in the Air Force's F-105D fighter-bomber. The system will be housed in a detachable platform that fits into the bomb bay of the aircraft. Immediately after taking the required photographs, it processes and prints them and then ejects these photos from the air to a command station on the ground where they can be studied for strategic purposes. According to Republic officials, the entire procedure can be accomplished within minutes.

CBS ELECTRONICS, a division of Columbia Broadcasting System, Inc., will concentrate its future efforts in the fields of semiconductors, microelectronics, sophisticated electron tubes, and other electronic products and discontinue its receiving tube operations, it was announced by Clarence H. Hopper, President of CBS Electronics. Raytheon Co., which will purchase a portion of the CBS entertainment type receiving tube inventory, plans to offer sales and service of these products to CBS customers, according to CBS.

GE'S TEMPO COMPONENT will participate in Project Vela, an extensive program of scientific research and systems development in the detection of underground and high altitude nuclear explosions. TEMPO's study will develop recommendations for an optimum world-wide system of control posts employing ground-based instrumentation for detecting nuclear explosions in the upper atmosphere and in space. The work will be conducted under a $233,339 contract awarded by the Air Force's Aeronautical Systems Center. General Electric Company's TEMPO component is a part of the company's Defense Systems Dept.

AUTOMATIC FLIGHT CONTROL SYSTEM developed by Sperry Phoenix Co. for jet transports will be incorporated in the Boeing 727 jetliner. The new system was disclosed as the Boeing Transport Division at Renton, Washington, announced award of a contract with Sperry Rand Corporation's Aeronautical Div. in Phoenix, Ariz., to develop the system, called the SP-50. Value of the contract over the next several years is estimated at more than $7 million. The Boeing 727, first of a new generation of commercial jets, is scheduled to enter passenger service in 1963.

STUDY CONTRACT for improving optical satellite observation and prediction techniques has been awarded to North American Aviation Inc. by the Electronic Systems Div. of the Air Force Systems Command. The amount of the 13-month study contract was undisclosed.

— GENERAL —

U.S. and U.S.S.R. PATENT OFFICIALS discussed technical developments which are covered by patents at a meeting in Moscow last month. A United States delegation left for Moscow on June 15 to engage in discussions with the All-Union Chamber of Commerce of the U.S.S.R. The technical mission to the U.S.S.R. was arranged by the National Patent Development Corp., which markets patents for American industrial corporations.

AEROSPACE TECHNOLOGY LITERATURE INDEX is being prepared by the Institute of the Aerospace Sciences under a grant from the National Science Foundation. Covering more than 10,000 documents selected for their scientific importance and research value, this index is designed to expedite the flow of urgently needed research information to scientists and engineers actively working in the nation's space and missile programs and in the design and production of advanced aircraft of all types. This index, which will be issued in book form early in 1962, will serve as a key to publications being abstracted this year in "International Aerospace Abstracts," a monthly IAS service.

AFRICAN BUSINESS DEVELOPMENTS, a news bulletin service, reports that Western Nigeria will spend some $40 million on water supply development over the next five years. In another item, the bulletin states that a four man New York University team has gone to Ghana and Nigeria to ascertain how the University might best contribute to planning and carrying out human resource development programs. The bulletin is issued by the Wallace Clark Center of International Management at N. Y. University.

COMING EVENTS:

JULY 10-14: Institute in Technical and Industrial Communications, Colorado State University.

JULY 10-14: Conference on Optical Instruments and Techniques, sponsored by the International Commission for Optics, London, England.

JULY 16-21: International Conference on Medical Electronics and Conference on Electrical Techniques in Medicine and Biology, sponsored by the American Institute of Electrical Engineers, the Institute of Radio Engineers and the Instrument Society of America, Waldorf Astoria Hotel, New York City.

A NEW MAJOR AIR FORCE COMMAND

The Air Force Communications Service was activated on July 1 as the 16th major Air Force Command. Headed by Major General Harold W. Grant, USAF, this new command assumes control on a global basis of all point-to-point, air and ground communication facilities under Air Force jurisdiction. AFCS headquarters will be at Scott Air Force Base, Illinois, and the organization will report directly to the Chief of Staff, U. S. Air Force.

Appointed Director of Communications-Electronics in 1958, General Grant was named Director of Telecommunications in July 1960 when the communications-electronics command was redesignated.

Succeeding General Grant as Director of Telecommunications is Major General John B. Bestic, USAF, who served as Deputy Director of Communications-Electronics and, more recently, as Deputy Director of Telecommunications.

The Armed Forces Communications and Electronics Association salutes the new Air Force command and wishes General Grant success in his new post. As a national vice president of AFCEA during his tenure as Telecommunications Director, General Grant contributed generously of his time and effort to further the Association's aim of military-industry cooperation.

MAJOR GENERAL HAROLD W. GRANT
Commander
Air Force Communications Service

COMMUNICATIONS UNDER ANY CONDITIONS

Consistent with its policy of thinking and working years ahead, ITT Federal Laboratories has been concerned with the communications problems which might arise in extreme emergencies. That, surely, is when the need for rapid interchange of information would be greatest, and where the system and equipment would have to be absolutely reliable.

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needs and impacts of

BASIC RESEARCH

by THOMAS MELOY
Chairman of the Board of Directors
Melpar, Inc.

SINCE DISCUSSIONS of basic research usually wind up in semantic confusion before they are through, I think it would be desirable to define basic research at the very beginning.

Some years ago I was a member of the Collegemen's Al Smith for President Democratic Club. In teaching us campaigning, Al Smith said, "When you know what you are talking about and you have a clear issue, discuss it in detail and at length, and with honesty. When you don't know what you are talking about and you don't have a clear issue, talk about the weather."

I am going to talk about the weather—semantic weather.

The definition of basic research always comes up when plans, directions, and particularly money are involved. Industry and the government do not differ much in their attitude toward and administration of basic research. Basic research is like reform. Everybody is for it, but nobody wants to pay for it.

Definition becomes tremendously important—when the Department of Defense has to use some of its precious funds. Definition is essential when it affects dollars. How many angels can dance on the point of a pin is a pleasant philosophical exercise, so long as one does not have to pay so many dollars per angel.

The Department of Defense defined basic research as that type of research which is directed toward the increase of knowledge. Vannevar Bush said: "Basic Research is performed without thought of practical ends. [It] leads to new knowledge. It provides scientific capital."

The definition used by the National Science Foundation is: "Basic research is that type of research which is directed toward increase of knowledge in science. It is research where the primary aim of the investigator is a fuller knowledge or understanding of the subject under study, rather than a practical application thereof."

Dr. Alan T. Waterman said one objection to the above definition is the question: "How can one determine the investigator's motives? If one feels he must make a psychiatric test of an individual to determine *why* he wants to do a piece of research, then it is undoubtedly *basic*."

I agree, but who checks on the psychiatrist?

It is obvious that it would be very wonderful to have basic research finally defined. I strongly recommend that this be done—that some individual be commissioned to do it, and that it then be made a matter of law. I recommend, moreover that this not be given to a committee. For the purposes of this article I am going to define it. I suggest you either use my definition, or make one of your own tomorrow, and then try to make it permanent, at least for a few months and at least for a few laboratories.

My definition is: *basic research is research devoted to problems, the fundamentals of which or the reasons for which, are not understood.* This can cover such varied subjects as the nature of smell or the nature of the changes in solid propellants after loading.

One of the best examples of the difference between basic research and applied research and development is the difference between the Manhattan Project and the efforts to find the causes and cure of cancer. In, and around 1937, the nature of fission in U235 was discovered by basic research. At that time anyone with a practical mind could see the possibilities of using the large amounts of energy released for a bomb and for energy to generate electricity and other industrial or "peaceful uses." It was also obvious to anyone with the aforementioned practical mind that it would be easier to make a bomb that would be immediately useful, than to build equipment to generate power which could compete with existing power plants.

The Manhattan Project started with well defined parameters and specifications needed for making a bomb which could be delivered by an airplane. Thus it was possible to carry out an applied research and development program necessary to make the bomb. Billions of dollars were spent with a very considerable end result.

It has often been asked why couldn't we have a "Manhattan Project" that would channel several billions of dollars into finding a cancer cure? The answer is that a cancer cure will come only from basic research. We hardly even know the nature of the problem. We must find out more about cell behavior. When research discovers why normal cells change to cancer cells, then we can use applied research to develop a cure —if necessary even on a "Manhattan Project" scale. Not that we cannot use more money for cancer basic research.

Remaking the World

The impact of basic research cannot be overstated. It is remaking the world. It is imposing tremendous new responsibilities on society. It has already given the human animal so much superiority over his fellow mammals that he has subjected those he can use to slavery and threatens all the rest with oblivion. He is going right on—unless a breakthrough in sociology is achieved—to exterminate his own kind, or to continue to reproduce so rapidly that he will eat himself off this planet and plunge, like so many lemmings, into space (probably to the great relief of the other mammals), or to swarm like a hoard of locusts over the entire globe, leaving a desert for his monument.

If basic research were a profession which was paid for in terms of consultations and hours or materials as medicine, law or even operation of a filling station is, it would be the biggest and most profitable business ever known. Imagine a doctor who every time he cured one patient of one ill, obtained five more patients with twenty-five new ills. That is what is happening in basic research. Each discovery turns up more unknowns. Each new vista opens more

vistas, and sometimes these vistas lead to dangerous things.

The results of basic research in biology have cut down infant mortality, eradicated plagues, and instituted hygenics that caused the population explosion.

Biological research may have other impacts that would reverse this runaway growth of humanity. I refer to chemical and biological warfare whose potentials, as you know, have been increased considerably. Perhaps these achievements, have not had the publicity they deserve, although their destructive capabilities, compare favorably with bombs. The Soviets are said to be spending a hundred times more than we upon them for both offense and defense.

Impact of Light Sources

The basic research of the Signal Corps, for instance, has revolutionized transportation, communications and amusement. Solid state physics research is only at the beginning of its impact. The diode and the transistor were revolutionary in the improvement of every form of electronic application. Now comes the maser and the laser, especially the laser. The possible impact on our future by using the laser to amplify light and to produce coherent light is unimaginable. It means we have extended radio techniques to light. We will have a light telephone, a light radar, a light television. It means further significant strides in miniaturization. The much smaller electronic light components, when combined with techniques now used in molecular electronics, may put a whole system in a chassis the size and weight of a few postage stamps. We already have one such postage stamp sub-assembly at Melpar.

Consider the possible uses of a light source a hundred times more intense than the sun which maintains its intensity so that we can shine it on the moon, and by selecting the proper wave length, penetrate water. I must say I am more than casually interested in lasers through the work we are doing at Melpar with laser systems and molecular electronics, and the work being done at Isomet to grow the laser crystals.

Why Basic Research

We could go on enumerating the impacts of basic research for some time. Everyone, I am sure, can think of a few more, and some important ones I left out. Nobody doubts the impact and need of basic research—as everyone is for virtue and against sin—that is, all but a little now and then. But how much is the need and what should we pay for it and why?

If we were living in the golden days of the Edwardian Era, when the only way you could get to Europe was by a pleasant slow boat, there wouldn't really be any pressing need for basic research, except as scientists pursued it for knowledge itself.

Industry, with the Sherman Act to police it, could also engage in basic research profitably, because occasionally a discovery might overcome even the advantages of "sound business practices." But we aren't in the Edwardian age. McKinley is dead. It takes a missile twenty minutes to cross the ocean, and the need for basic research is survival.

He Who Rules the Weather

It is an obvious and epigrammatic statement that he who rules space rules the world. It is equally true, if not quite so obvious, that he who rules the weather, also rules the world. We recognize the need for basic research in space development. Undoubtedly if we had had a little more basic research in the nature and reactions of propellants, especially solid propellants, we might be even with or ahead of Russia.

The race for supremacy in space is in both the applied and basic research stages. The program constantly turns up new data, which needs to be studied, to be explored and to be understood. Again we can say epigrammatically that he who has adequate basic research will eventually rule space or come close to it.

If one had to make a guess as to which subject has had the most publicity in terms of numbers of words spoken since language began, it would probably be weather. Forecasting weather was probably the first science, but it is only recently, after fifty thousand years or more, that tangible progress is being made. It begins to look as if weather could be controlled. This might confer God-like powers. One could make the Sahara desert into the equivalent of the Middle West farm belt, and conversely make the Middle West into a Sahara. One could enjoy the convenience of sending hurricanes to any spot when, as and if, it seemed desirable.

A meteorology department could be more important in terms of dollars than our ballistic missile complexes. However, we need a lot of basic research before the effective control stage is reached, research embodying many disciplines, such as physics, chemistry, meteorology, geology, climatology, oceanography, astronomy, electronics, and above all, mathematics.

The need for basic research in mathematics is very great. We cannot have too much of it. It is basic to all scientific progress. I have found that so many people think of mathematics as static science, some sort of elaborate and mysterious numerology exercise. Fortunately, more and more young people are considering mathematics as a major while at the same time the importance of mathematic teaching is being given greater consideration.

We could go on enumerating needs for basic research for some time. Particle physics research today is what nuclear physics was in the thirties. Biology, oceanography, plasmas, materials, and the many other disciplines, require basic research which will undoubtedly achieve results the nature of which and the use of which, cannot now be evaluated.

Without Restriction

In discussing the needs of basic research, it is necessary to consider under what climate it is done. Everyone agrees the best results can be achieved by free men working without restrictions. They must be isolated as much as possible from deadlines and the pressure to get specific results.

The success of Russian scientific development appears to have been due in large part by the fact that it was kept out of politics. Russian scientists were given unusual privileges and unusual freedoms. The place of the scientist and the teacher of science was only second to the commissars themselves.

However, a recent dispatch from Russia, carried by *The New York Times*, is encouraging. It stated that the Soviet government had undertaken to reorganize all the basic sciences and research and development, and to place them under one head, so that greater efficiencies could be realized and so that the results could be applied more directly and quickly to industrial and military needs. The system is to be headed by a high ranking military communist official and is to be replete with the usual erudite and distinguished committees. Possibly basic research in Russia won't be so fruitful from now on.

I repeat again that basic research is essential to our welfare and our survival. It has always been the seed of progress and now it is also the seed of freedom. All of us should pay for it gladly and without stint.

Education in Public Affairs

(*Continued from page* 15)

along with government loans and grants to the emerging and underdeveloped nations. We must distinguish also between these emerging and underdeveloped nations and the type of aid that we gave under the Marshall Plan to the more advanced and industrialized Western actions. In carrying out these aid programs, I think it is obvious that the government and business must be in partnership. And it should be the government's job to create a climate that will encourage private capital to venture into these areas with a reasonable degree of security.

But it will behoove business to operate under government supervision along the lines of 20th Century capitalism rather than 19th Century capitalism, which we so often are accused of doing when we pass the 3 mile limit off-shore. At any rate, business has a good opportunity to make a profit and at the same time, further our national efforts to develop an understanding and appreciation for the free enterprise system.

In this connection, I would also like to mention that it has been alleged that, in our colleges, we are not teaching an understanding of free enterprise but are almost teaching socialism instead, and that profit is becoming a dirty word. I hope this isn't true. I would like to point out that this economic war is just as dangerous as a hot war, for if we lose this economic war, we can't support our military effort. We will lose our allies. We will lose our world influence, our world standing, and I think we would jeopardize the political stability of this nation, for only the strong can be free and only the productive can be strong, and we must remember this.

Certainly one of our goals must be to preserve the strength of our own economy and the strength of our allies' economies. And this is going to be extremely difficult in a democracy. We must maintain unity of political purpose with the free and industrial western nations while we compete with them in a free enterprise system and under democratic governments.

I am sure we recognize that democracy may not be the most efficient form of government, although it is the best in my judgment. It is open to abuse by the self-seeking groups. We can't let these self-seeking groups, by their political action, make us insolvent and undermine our strength.

We are living in a very turbulen and a very revolutionary world an we are facing some very grave dan gers, but I would be remiss if didn't at this time state that in my opinion we have no cause for alarm or panic if we will but use the strength that is available to us— moral, capital and spiritual. For our total strength, both relative and qualitative and quantitative, is greater; our challenge is to utilize it properly. I am convinced that we can't utilize it properly unless we have good leadership and broad public understanding of the issues of the day.

In any evaluation of relative strengths, let us be careful not to over-rate or under-rate our enemy or ourselves. Let us know the situation and then with this knowledge let us apply our resources accordingly.

I am certain that more and more people are recognizing that we as a nation must recapture our public conscience if we are to successfully deal with Communism's iron purpose. Our citizens must recognize that political freedom can be sustained only by continuing individual effort. I cannot stress too strongly that we must earn it by an understanding of the issues by our citizens and by their participation and interest.

The Rockefeller Committee reported that it will take a sustained and an intense national effort if we are going to stop an assault on our civilization. But if our citizens are not aware of the world that we are living in, if they don't recognize that citizenship carries responsibilities as well as privileges, if they aren't willing to take the time from their personal affairs to understand the problems of government, if they aren't willing to make the sacrifices or self-denial to the degree that they might be required in a cold war as well as they have in a hot war, if they don't recognize the need to give the national good first priority over their private concerns, then I think that we do have cause for real concern. For let us make no mistake about it, we are in total conflict, a conflict not of our own choosing, and we are fighting a very formidable foe. We are fighting for our survival as a nation and of the Free World. Our survival will, in large measure, depend on the degree of recognition by our citizens of the danger the nation faces and on their willingness to do things which will become obvious. Education, both in our school system and in adult programs can greatly influence the results.

High priority, graphic communication data covering the full spectrum of business messages — from full scale drawings to two letters at a time — are examined at a demonstration of Alden High Speed Facsimile.

Now!... Practical, High-Speed Facsimile for the High Priority Graphic Information of Government, Industry & Commerce

In facsimile — the key to cost is utilization of transmission lines and equipment. So far, the biggest expense has been line cost. The greatest bar to full utilization of systems has been lack of flexibility in equipment.

Line costs are now plummeting — through the great increase in private "voice" networks, the recent availability of private microwave channels, and the filing of tariffs by A. T. & T. Company of low cost, broad channel communication links in their "Telpak" offering.

Alden facsimile equipment has the proven flexibility . . .

to take documentary copy of any size and shape, to operate on any channel (microwave, "voice" channel, broad channel), to operate at any speed (from 8 min. letter to 2 letters/min. or at any higher speed) with proven, practical designs . . . (standard equipment for the U. S. Weather Bureau on 2 national and territorial networks).

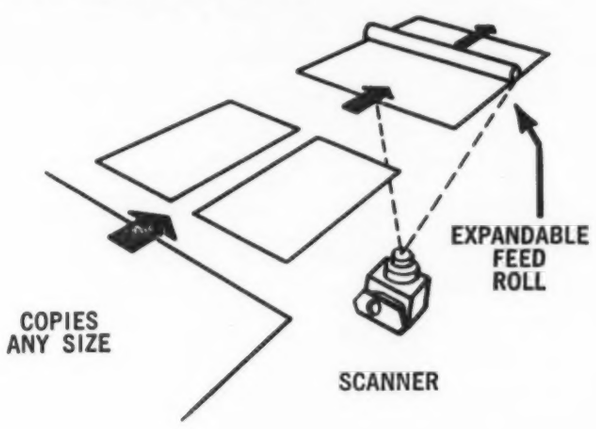
Alden equipment handles the entire spectrum of high priority graphic information.

Not restricted to letter size copy, Alden Flat Copy Scanners readily accept originals of any length, width or thickness. They have the flexibility to transmit everything from full scale layouts and plan drawings to 2 letters at a time or small size messages whether shingled or in parallel. Messages can be fed continuously or selectively scanned for greatest flexibility. The tremendous variety of messages that can be sent results in *highest utilization of equipment* for all high priority graphic information.

Alden equipment can load match the traffic of any system.

Not only the entire spectrum of size, length and thickness of copy can be handled — but the most practical speed for the load can be chosen from standard Alden equipment to get the *highest utilization* of the communication link or channel selected. Alden equipment is not fixed at high or low speed. Through the use of modern tape equipment the ability to store at one speed and transmit at another gives *complete flexibility* to any systems layout — insuring highest utilization.

COPY CAN BE FED CONTINUOUSLY IN ALDEN FLAT COPY SCANNER 19" WIDE

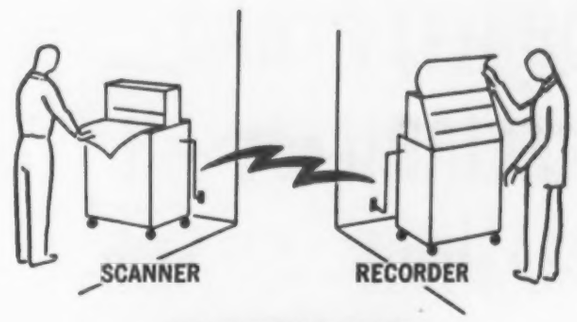


Alden equipment is designed as self-contained, modular units . . .

with low maintenance and running costs. Scanners can be placed wherever information is developed — fed into the facsimile communication system or network — and recorder placed wherever information needs to be utilized.

The ability to get highest utilization —

from Alden equipment does not come about by accident, but is made possible by the techniques Alden has pioneered.



ANY DISTANCE APART . . .
WHEREVER NEEDED

Alfax Paper and Alden Recording Techniques

From 1930 on, Alden has continuously engaged in facsimile development and application. Most significant was the development of Alfax "A" Recording Papers — the first and only stable and high speed electro-sensitive recording paper, which combined with Alden "adjusterless" Recording Techniques and simplified Flat Copy Scanning — form the basis for the important breakthrough in practical facsimile equipment and systems.

In 1946 ALDEN ELECTRONICS was set up as a manufacturer's manufacturer to supply systems, equipment, component recorders, scanners and their elements to users, OEM, and R&D groups in facsimile and instant graphic recording fields. This company can serve as the key to exploiting the new horizons opened by Alfax "A" Paper (1) and Alden Recording and Scanning techniques (2) and to benefit from the electronic packaging and manufacturing techniques of the original Alden Products Company (3).

TODAY — Alden Electronics' equipment is standard throughout two national U. S. Weather Bureau facsimile networks. Backed up by over 200 service centers throughout the nation. Alfax Paper and Alden Recorders are also superimposing a whole new strata of instant graphic "quick see" recording devices in every scientific field from Oceanography to Radio Astronomy.

It is the fastest growing company in the facsimile field and is being joined by outstanding leaders who find that Alden recording techniques and Alfax "A" papers can expand and develop their markets.

1. ALFAX PAPER & ENGINEERING CO., INC.
making Alfax paper available to all for use or re-sale without restriction.

2. ALDEN RESEARCH FOUNDATION
providing an integrated and coordinated program for the use of Alden techniques and know-how.

3. ALDEN PRODUCTS COMPANY
making available the basic components to mount, house, fasten and connect electronic circuitry so that equipment is simple to roll-in, plug-in, operate and maintain.

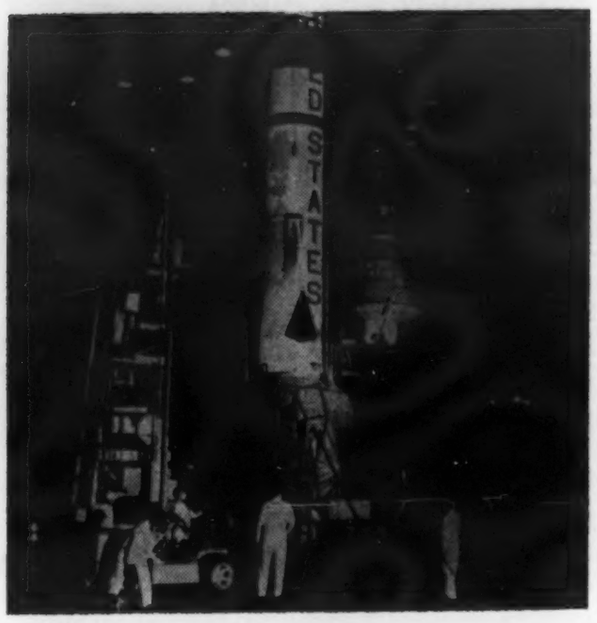
ALDEN ELECTRONIC AND IMPULSE RECORDING EQUIP. COMPANY, INC.

can serve you as the key element of the only integrated team for providing every essential element from basic parts to complete systems in the facsimile field.

We invite your inquiries.

ALDEN RESEARCH CENTER
Westboro, Massachusetts U.S.A.

QUALITY AND RELIABILITY IN MANNED SPACE FLIGHTS



by EVERETT H. DALE
Quality Manager, Aeronautical Div.
Minneapolis-Honeywell Regulator Co.

TODAY WE TALK of space travel on the edge of our Earth's environment. On May 5, we listened anxiously and intently as we heard our first astronaut, Commander Alan B. Shepard, Jr., report back by radio of his flight's progress some 115 miles up over the Atlantic. Tomorrow we will look forward to our eventual success in overcoming the complexities surrounding ventures which will penetrate much deeper into space.

One of our principal areas of concern in manned space flight is the aspect of quality and reliability. How can we assure ourselves that our next venture will have a high success probability? Are we taking enough steps during development efforts to assure ourselves that our systems are inherently reliable by virtue of their design? Are we providing the quality assurance steps necessary to retain that inherent reliability throughout all phases of product manufacture? The problem for successful action today rests with our ability to conquer the reliability problem, or better still, the unreliability problem. Although I speak from our company's experiences gained primarily in guidance and control work on all types of aircraft and space vehicles, the solution of the unreliability problem as it exists in our industry is paralleled in all other endeavors related to manned space flight.

Of the first 39 satellites that the U. S. has successfully placed in orbit, thirty of these were guided by Honeywell inertial systems or have used Honeywell precision floated gyros in the guidance system. To enter this new era of space activity, we have had to move forward both organizationally and technically to insure high equipment reliability. We have taken extreme precaution to introduce our reliability control measures early in the design concept stage. This we have done by making our reliability engineering effort an integral part of the total engineering effort. This action is then backed up by a quality assurance program directed at obtaining uniformity in product quality equal to the expectation of the reliability predictions and tests conducted early in each design program.

With the introduction of an element of national pride into space activity accomplishment, the reliability and quality assurance provisions as they affect the success of individual space shots are directly exposed to an interested public audience. Successes and failures of the future will remain in sharp focus to all observers. The problems related to unreliability will receive maximum attention from both the scientific and industrial world. Congress, with the financial interests of the nation, will retain constant interest in industry's achievements.

Project Mercury

On the basis of past progress in reliability and quality assurance of complex systems, I would like to describe some of the specific operational and reliability activities on Project Mercury. I also will consider the X-15 and Dyna Soar programs.

Many of the instruments and controls on the Mercury capsule resulted from human factors studies. These studies involved the scientific analysis of the relationship between the astronaut and his space capsule and a determination of the work that each could do best.

The Automatic Stabilization and Control System (ASCS) developed for the Mercury project was designed to provide automatic stabilization and orientation of the capsule continuously from the time of separation from the booster adapter until the landing parachute is deployed, whether this is during a normal or aborted mission. The entire concept of the program was the use of proven off-the-shelf hardware. Extreme reliability was achieved through co plete system redundancy. For ample, in addition to the ASCS, astronaut has three other back control systems available to him, i fly-by-wire, manual and manual w Honeywell supplied damper. T concept of redundancy is carri throughout all phases of the capsu Another example, the periscope, backed up with a Honeywell ea path indicator. A further examp the environmental system, is back up by the pilot's own suit which is environmentally controlled system itself. The suit also has a self co tained control system which is third environmental system.

There are four steps in the gener sequence of operation of the ASC These controlled maneuvers helpe the manned vehicle survive the sho and heat of re-entry.

1. *Launch* — A Redstone rock boosted the astronaut's spacecraft u into space in just 2½ minutes an then dropped away from the capsul The Attitude Stabilization and Co trol System damped out any tendenc for the vehicle to tumble and held in the attitude of separation.

2. *Yaw Around*—Then the syste yawed the spacecraft around (swun it around sidewise) so that the blun heat shield end was facing forwar and tilted upward 14°.

3. *Brake*—Later, the upward ti was increased to 34° and retr rockets were fired. The spacecra was also turned so that the hea shield was downward for re-entry.

4. *Spin*—Upon sensing a .05 deceleration — during re-entry, th system started the spacecraft revol ing at 10° per second. At 70,000 fee a drogue chute was released and th system disconnected. The spacecra splashed into the ocean and the astro naut was picked up safely.

Honeywell's reliability program fo its Mercury project participation wa made part of the design, productio and quality test programs of th Automatic Stabilization and Contro System and Rate Stabilization an Control System.

The systems operation and make-u were studied from its inception wit a view to the eventual reliability. Fo example: Two systems were designed one utilizing relays and one utilizin the solid state applications. Reli abilty considerations of the two sys tems were compared and the soli state system was selected. Th selected circuitry was then develope and scrutinized further so far a reliability is concerned. An exampl of the reliability input at this poin is as follows:

Logic circuit switching can be made to function either on application of a signal or removal of a signal. Examination revealed that a majority of the functions were performed on the removal of a signal. This is not desirable from the standpoint of reliability since a broken wire then causes a function rather than eliminating the possibility of a function; for instance, during orbital control where thrust pulses are used, if one pulse is missed, the next pulse will give control. However, a continuous thrust caused by a sustained function could not be corrected. On the basis of reliability, the design was changed at this point.

For the Honeywell supplied systems on Project Mercury, McDonnell Aircraft Corp., our customer, imposed a specific MTBF (mean-time-between-failure) requirement. A simple summation of all the separate parts reliability factors indicated a predicted reliability of within ½ of 1% of the MTBF specified. However, if the mission is considered and the operation is broken down to the basic modes of orientation and retro, orbit and re-entry, the probability of successful operation of each mode can be calculated. Since all of the equipment is not functioning during all of the modes of operation, the total system mission reliability as a combination of the mode reliabilities is equivalent to 6.5 percent greater than that predicted. Actual performance based on simulated flight tests has indicated an MTBF 43 percent higher than the requirement.

A parts application analysis was performed. This application or stress analysis as it is sometimes called, is a study of each part and its use in the system. For each part, such as a resistor, diode or transistor, the following information was obtained: The failure rate, vendors rating, temperature at which the rating applied, actual temperature in the application, rating of the part at that temperature and the actual use or stress in the application. This analysis was effective and did result in changes in several of our initial selections.

Failure Effects Analysis

A failure effects analysis was conducted on the system with the objective of determining the final effect on the capsule of a failure occurring in any part of the system. Since we are interested in the end result of the mission, the approach was that the failure of a function is the determining factor, not the failure of the part. A relay and its circuitry is composed of many parts—coil, armature, contacts, wires, pins, wiper, diodes and perhaps a driving transistor. However, no matter what malfunction occurs, the end result is one of two things—either the relay fails to close or it fails to open when required. This analysis was then conducted on a functional failure basis to assure a complete analysis with the minimum repetition.

As far as the capsule is concerned, the extent of any functional failure was indicated on a failure mode analysis worksheet by control system effect and the type of motion of the capsule.

All failures were reported during qualification, reliability, subcontractor and prime contractor acceptance testing. A record of all failures was made on a failure report and analysis key sort card system.

X-15 and Dyna Soar Programs

In another step in conquering the problems of manned space flight, hypersonic aerospace vehicles are being developed to venture through a wide range of environments. Both the X-15 and the Dyna Soar, in this step, must include provision for aerodynamic control and reaction control. For these programs, the flight control systems must have extremely high short term mission reliability requirements with far less back-up redundancy from other systems than that possible in Project Mercury.

Honeywell has developed a flight control system for the aerospace vehicles in this class. Under a contract with Wright Air Development Division, a system has been developed to overcome flight control problems encountered by the X-15 vehicle. This vehicle has an extremely wide flight envelope. The flight characteristics of this vehicle are such that during specific flight profiles, especially on high angle of attack reentry conditions, a high-quality damper system must be available capable of providing continuously the desired gain levels during rapidly changing flight environment. A dual-redundant adaptive automatic flight control system has been developed to meet these needs. This same basic philosophy of flight control system design is being applied to the Dyna Soar vehicle.

This dual redundant adaptive mechanization which is being applied to resolve this problem was developed with several objectives in mind as means of improving system quality and reliability. These are:

- Provide a failsafe operation.
- Provide adaptive control with its inherent automatic gain compensation for most failures.
- Utilize limiting and component failure logic circuits at specific points to provide continuous operation in the event of any single failure.

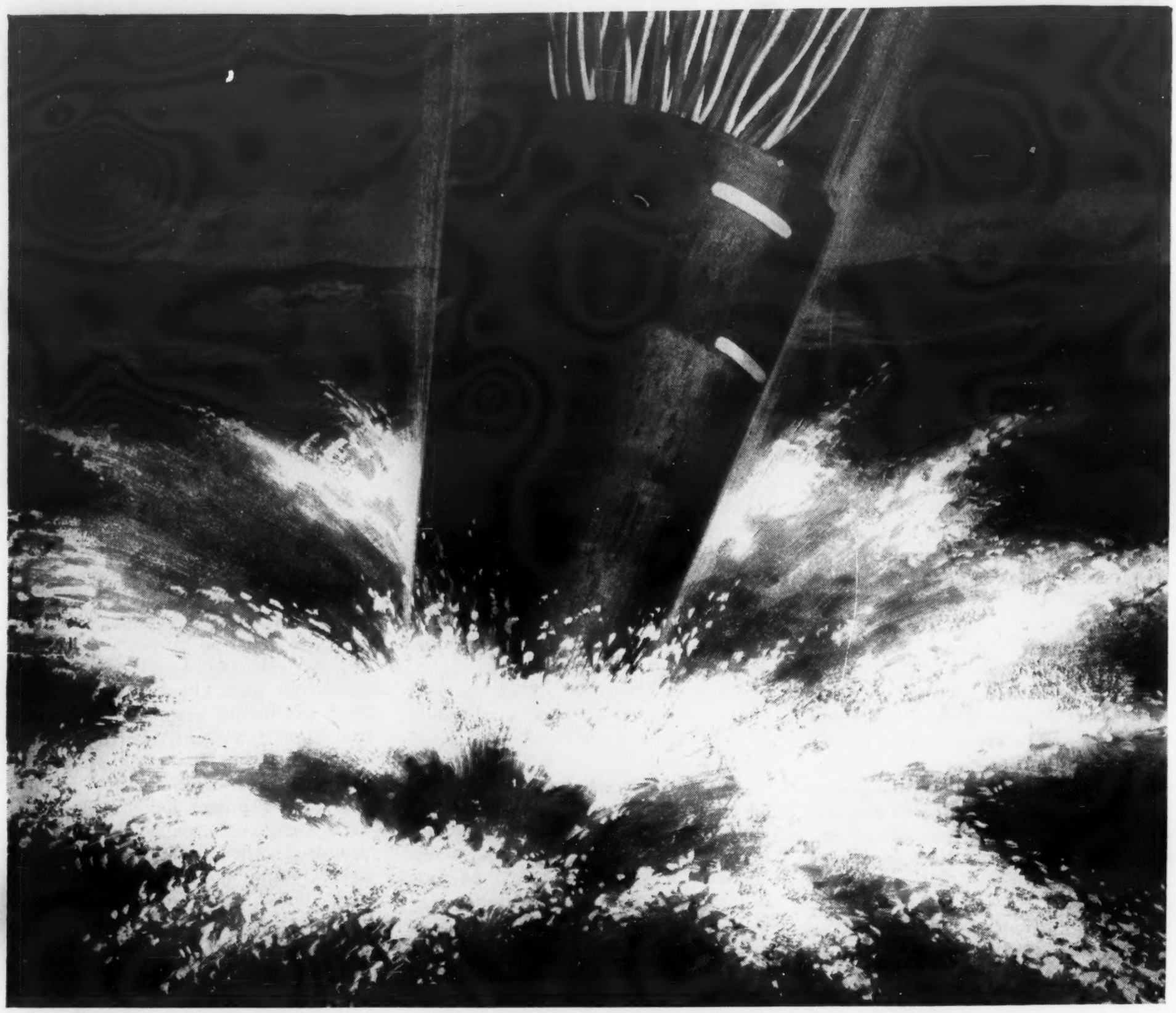
As a solution, the merits of redundancy were blended with a new concept in adaptive mechanization. Prior to this development, redundancy was seldom used except for an occasional component redundancy. To compute the reliability of the single channel systems, we merely apply the chain law. In order to meet the demands of high reliability, Honeywell has resorted to the use of device and channel redundancy.

The Honeywell adaptive control system is especially suited for controlling vehicles which spend periods of time outside the earth's atmosphere. Since such vehicles utilize both reaction and aerodynamic control for maneuvering, there will be significant gain changes in the moment producing system whenever a transition is made. A particular advantage of the Honeywell system is that the gain changes are instantaneously compensated for, so that the system performance is not compromised when either reaction or aerodynamic control is dominant. This should also result in more efficient utilization of the fuel carried for maneuvering the airplane.

A model is used to shape the vehicle response to the desired response characteristics for all commands. The vehicle is made to follow the output of the model by maintaining a high-gain control loop following the model commands. This control loop (including a rate gyro, amplifier, variable gain, servo, surface actuator, and aircraft) must have a bandwidth at least three times the bandwidth of the model to prevent further shaping of the command due to the controller dynamics. This adaptive technique provides uniform aircraft response to commands throughout the flight envelope by varying the flight control system gain as an inverse function of the aircraft surface effectiveness through the operation of the self-contained gain computer. Thus, the adaptive concept is independent of the air data inputs from a central air data computer, which is an important consideration when providing a failsafe redundant mechanization.

The advantage of utilizing redundant adaptive controllers lies in the

(*Continued on page* 37)



How the ocean grew "ears" to pinpoint missile shots

A quarter of the world away from its launching pad an experimental missile nose cone splashes into the ocean.

How close has it come to the target?

Where can it be found, recovered and studied?

To answer these questions quickly and accurately, Bell Telephone scientists have developed a special system of deep-sea hydrophones—sensitive "ears" that hear underwater. Its name—the Missile Impact Locating System, or MILS for short. MILS, produced by Western Electric, manufacturing and supply unit of the Bell System, involves two types of networks.

- One is a Long Distance network which monitors millions of square miles of ocean. The nose cone releases a small bomb which sinks and explodes at optimum depth for transmission of underwater sounds. Vibrations are picked up by hydrophones stationed at optimum depth and instantly carried by cables to ground stations. Since the vibrations take longer to reach some hydrophones than others, time differences are measured to compute the location of the nose cone.
- The other is a "bull's-eye" network which monitors a restricted target area. This network is so sensitive that no bomb is needed. It can detect the mere splash of an arriving nose cone and precisely fix its location.

MILS is now operating in both the Atlantic and the Pacific test ranges. It was installed by the U. S. Navy with technical assistance from Western Electric.

It's still another example of how the universe of sound—below the sea, above the earth, in outer space—is constantly being explored by the Bell Telephone System.

BELL TELEPHONE SYSTEM

AMERICAN TEL. & TEL. CO. / WESTERN ELECTRIC CO. / BELL TELEPHONE LABORATORIES / 21 OPERATING COMPANIES

fact that either adaptive controller can automatically provide the desired vehicle flight control in the event of most failures. Development work on the redundant adaptive control concept has also included failsafety test work on the X-15 simulator which verified previous test results achieved on a simplified study.

The specific redundant controller which has been developed takes advantage of various redundant techniques and adaptive flight control concepts currently in use. It utilizes these existing techniques through the unique application of a failsafe, dual-redundant gain changer. This combination provides a significant increase in the system reliability, while maintaining failsafe, adaptive flight control operation for any single failure of the redundant elements.

Although certain penalties of volume, weight and power consumption become significant when redundancy is employed, the combination of dual-redundancy and adaptive consideration provides an optimum condition.

The significant increase in reliability achieved by this approach appears to make this concept very attractive for any flight vehicle which requires stability augmentation at critical flight conditions for relatively short missions.

Conclusions

What are the quality and reliability requirements for further extensions of manned space flight such as Apollo? Can we expect to have success when the mission time is extended appreciably? Is redundancy in system a solution or will the weight versus reliability tradeoff relationship become a limiting factor? We feel confident that an approach such as the dual-redundant adaptive flight control system is adequate to meet the reliability requirements of edge of space manned flights. Our confidence, however, depends upon suitable system maintenance between flights. What then can be done when the flight time grows longer and the advantages of periodic ground maintenance are lost? In extended flights, *man* will have some time during his programmed activity to monitor and service his systems. Significant human factors studies are in progress to determine man's capability as a part of the total man-machine mix. Man's function in space will certainly be multi-purpose and include activities in which automated equipment is not and will not be available in the forseeable future. He will also play a large part in situations involving maneuvering, entry and reentry and landing on surfaces not well known.

On the weight versus reliability question, the promise of substantial weight reduction possibilities from new techniques in microminaturization may ease the problem and permit substantial use of redundancy without too severe a penalty.

Are economics and high reliability compatible? Yes, if we make full utilization of our past experience and consider a high success probability more economical than numerous failures.

The future challenges in obtaining high Quality and Reliability for control of manned space flights lie before us. *Some* of these are:

- The development of in-flight equipment monitoring and repair programs which will serve in the same manner as ground based maintenance.
- The development of reliable lightweight test equipment to allow implementation of this approach.
- Improvement in reliability prediction and design analysis techniques so as to increase our confidence in them.
- The development of superior means of assessing reliability of basic electronic parts and components on small run lots.
- Discovery of the optimum design for reliability with full consideration of expected failure modes.

We are confident that both the scientific and industrial community are accepting the challenges and will provide the required answers with greater vigor than ever before.

MERCURY COMMUNICATIONS SYSTEM

SIGNAL STAFF REPORT

COMMUNICATIONS equipment inside the Mercury capsule consists of a two-way voice radio, a receiver for commands from the ground, telemetry equipment for transmission of data from the capsule to ground stations, and a radio tracking beacon. This communications equipment is supplemented by the special recovery aids.

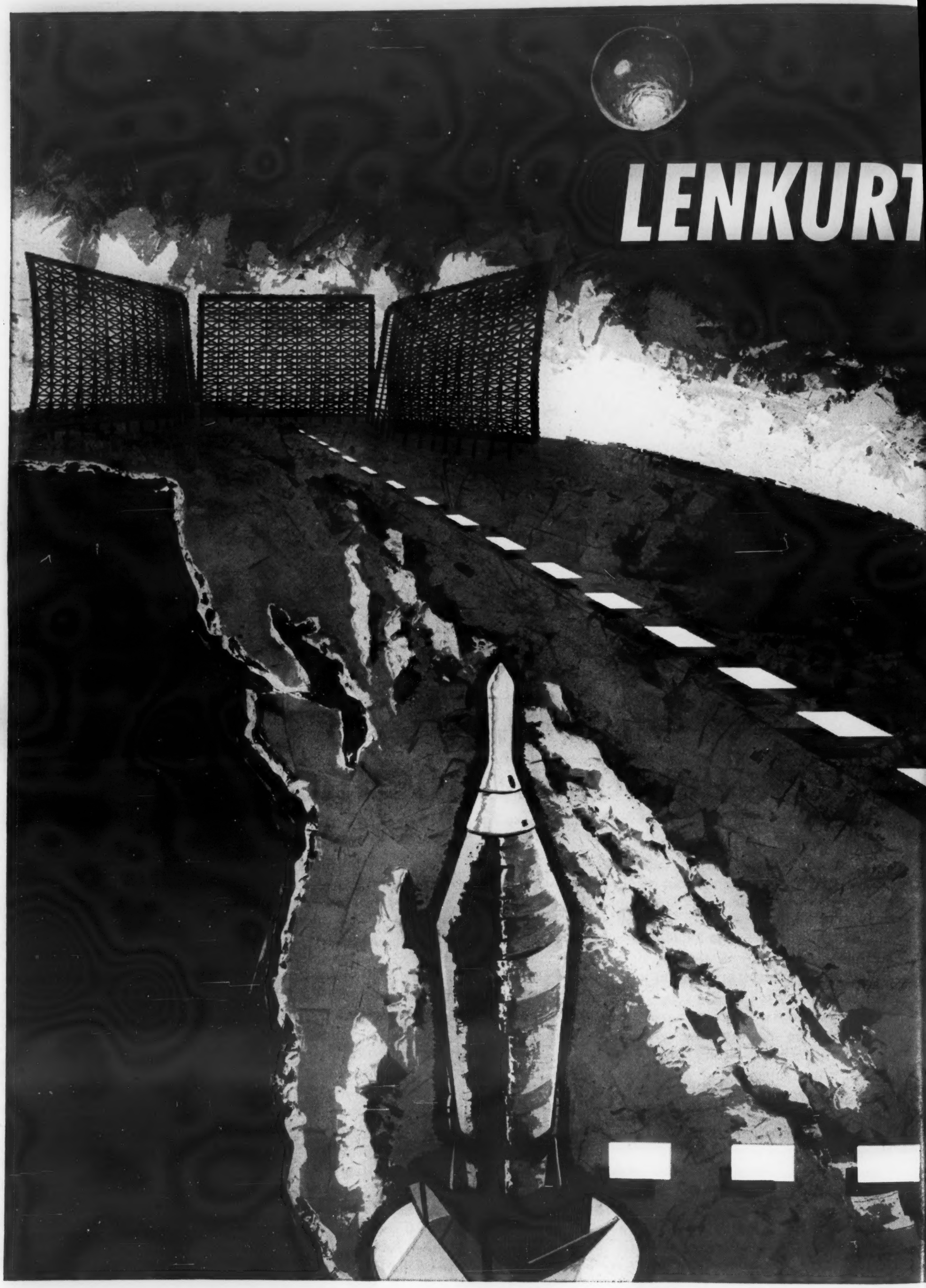
In addition to providing voice communications during the launching, flight and recovery operations of the Mercury spacecraft, the communications system provides other vital functions. Command receivers aboard the capsule permit ground control stations to send directions to the capsule, i.e., operators on the ground can turn on and off the capsule's attitude control jets changing the capsule's attitude in space. During orbit the command receivers enable the ground operators to fire the capsule's retro rockets at the proper time so that the capsule returns to its designated area in the Atlantic Ocean.

Telemetry transmitters relay important aeromedical information to scientists on earth about the astronaut's physiological behavior as he goes through the flight, including his pulse rate, his temperature, and other reactions. Additional scientific and operational information is also transmitted from the spacecraft to ground stations by the telemetry transmitter.

Microwave radar beacons transmitting from the capsule permit pinpoint tracking by ground stations as the Mercury vehicle soars through space, giving ground control headquarters an accurate picture of the location of the capsule at all times.

Special "rescue" transmitters take over after the capsule has parachuted to earth. Then aircraft and surface ships locate the returned capsule by use of their direction finders. Voice communications transceivers used throughout the astronaut's flight also are used during rescue and recovery operations.

Collins Radio Company designed and produced the communications system inside the Mercury capsule, in cooperation with a team of eight subcontractors. Subcontractors are Andrea Radio Corporation; ACF Electronics Division of ACF; Melpar, Inc.; Microphase Corporation; Motorola, Inc.; Simmonds Precision Products, Inc.; Texas Instruments, Inc.; Transco Products, Inc.


LENKURT

TELECOMMUNICATIONS

help spaceguard the nation's lines of defense

Lenkurt multiplex and microwave systems play an integral part in providing the steady sets of nerves interconnecting large portions of the armed forces' vast intercontinental defense, alerting and logistical networks.

These integrated communication and control systems are equipped to simultaneously transmit voice, telegraph, facsimile, and digital data at high speeds with extreme reliability and accuracy.

The range of specialized and general-purpose Lenkurt telecommunication systems include such networks as:

- the shockproof systems providing centralized control through underground communications at Atlas-Titan hardened missile sites.
- a "real-time" data system at Cape Canaveral which helps supply instantaneous knowledge of missile trajectory.
- a 600-channel universal multiplex system capable of 100% data loading—developed and produced for ARDC as the standard Air Force multiplex system.

The list of major networks using Lenkurt telecommunication systems includes such famous names as BMEWS, DEWLINE, WHITE ALICE, SAGE, QUICK FIX, and many others.

Lenkurt Electric multiplex and microwave systems have been used by the armed forces in most of the major telecommunication systems since 1953. Today, far more sophisticated systems are being incorporated in some of the most advanced ground and space communication networks.

The most extensive independent facilities, exceptional experience, and extraordinary capabilities combine to make Lenkurt Electric a leading specialist in telecommunication systems.

• • •

Lenkurt Electric Co., Inc., San Carlos and Los Angeles, California; Washington, D. C.; Rome, New York.

LENKURT ELECTRIC

Subsidiary of

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

Specialists in VIDEO, VOICE and DATA TRANSMISSION

CIC FIELD ENGINEER'S REPORT

by
WILLIAM J. SIMPSON
Engineer in Charge
Eighth Radio District
Federal Communications Commission

THE FEDERAL COMMUNICATIONS COMMISSION's Eighth Radio District office in New Orleans, Louisiana, has always enjoyed good cooperation from the users and servicemen of radio transmitters in various communities in the elimination of interference.

In the small community, interference is not so much a problem as in large cities. For one thing, there are fewer transmitters and less likelihood of them causing interference. If interference is created, the field is narrow, and the offending transmitter is usually located quite easily without the assistance of the FCC. In addition, the equipment servicemen in a small community are generally personally acquainted, which assures cooperation in the elimination of the interference.

The situation in the large community is quite different, however. There are antennas on nearly every rooftop and the owner of one antenna does not know who owns the other antenna. There is a general mixture of frequencies, emission, and differences of power, all confined in one area. Along with each of these transmitters are one or more sensitive and sometimes not so selective receivers which are oftentimes susceptible to interference.

Before the Cooperative Interference Committees (CIC) were formed the problem of interference in the metropolitan areas was particularly difficult. It was the job of the FCC to receive the complaint, come to a preliminary conclusion as to the cause of the interference, contact the licensee of the offending station, and again contact the serviceman for the station receiving the interference. In many situations, the cause of the interference was still not determined by the servicemen and an FCC engineer had to be dispatched for an on-the-spot investigation.

With a CIC in operation, however, the case is handled much more effectively. The FCC district office receives a complaint of interference and refers the complaint to the CIC. In most cases the CIC takes over completely and then advises the FCC when the cause of the interference has been determined and corrected. By this efficient mode of operation the interference source is quickly located and eliminated. The FCC is only called in when the going gets tough or complications set in.

The gain in time and labor saved by the FCC is not necessarily at the expense of the members of the CIC. In the case of a complaint referred to the CIC, a CIC member who is located in the vicinity of the interference will make a preliminary investigation. If the case is particularly difficult, he calls a member who is more experienced with the type of interference that is involved. In some cases it is necessary to call in the FCC for information as to a certain licensee or frequency, or to inquire if the FCC has a particular piece of measuring equipment available to use in checking the interference.

Typical of radio interference cases solved by a CIC committee is one involving cross modulation which occurred in New Orleans. This case was handled by the Delta Radio Interference Committee, Incorporated.

A gas pipe line company operating on 48.78 Mc., an oil and refining company operating on 48.86 Mc., and another oil company operating on 48.94 Mc. were causing mutual interference to their radio systems in New Orleans. The interference was due to the same frequency separation between the end frequencies and the middle frequency of 48.86 Mc. This difference of 8 kc., when added to the carrier frequency of the stations, caused cross modulation products and disrupted reception to all of the stations. The interference was only noticeable when all three stations were transmitting simultaneously.

Since the frequency separation of the stations was too close to use even a high-Q cavity, through the assistance of CIC members a system was designed whereby a crystal in the input of the receiver was used as a very high-Q filter to reject one of the offending carriers, the crystal being ground to the carrier frequency to be rejected. When only one of the carriers was rejected, the cross modulation was thereby eliminated.

In addition to the assistance rendered to the FCC office by the CIC handling of interference cases, this office relies strongly on the Committee for advice and assistance in self-policing of the spectrum. Their advice has been found helpful especially in cases in which we could not ask for their direct assistance, such as interference at some isolated community not near a CIC. We have contacted Clyde Smith, president of our local CIC, many times to ask him what limitations of a particular model FM receiver were, what the I.F. frequency was of a certain receiver and its image rejection capabilities, whether he had encountered any trouble with a certain type transmitter, what solution had he found best for a particular type of interference, and other such questions. His replies are then forwarded to the serviceman in the small community who is trying to eliminate the interference, but has no experience in such procedures.

There is a need for the formal organization that is often incorporated and has a publication listing the members and procedures. Such organizations are especially helpful for the metropolitan areas. However, the CIC need not be a large organization. We also have a need for the small committees in the areas away from the metropolitan districts. One of our committees has been formed as both a CIC and a social organization. This gives the servicemen and users a chance to meet sociably and discuss their problems at the same time. Another CIC has been incorporated into the local chapter of the Associated Police Communications Officers. All have as their aims the promotion of effective radio communications and they have realized that this can best be done by cooperation among themselves and with the FCC.

AFCEA Sustaining and Group Members

Communications—Electronics—Photography

Listed below are the firms who are sustaining and group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

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Chapter News

REGION A

Boston

"The Crack in the Kremlin Wall" was discussed by retired Marine Corps Brigadier General Wendell H. Duplantis at the May 11 meeting held at the Civil Defense Headquarters, Harvard, Mass. General Duplantis is deputy assistant director for Communications and Warning in the Office of Civil and Defense Mobilization.

The speaker previously served as assistant administrator for Communications in the Federal Civil Defense Administration. Before that, he was a member of the Office of the Special Assistant to the Joint Chiefs of Staff for Mutual Defense Assistance Affairs.

The chapter has announced the election of officers for 1961-62. Edward T. Rigney, executive vice president and treasurer of Transonics, Inc., is the newly elected president. Vice presidents are: Clifford Falkenau, Sylvania Electronics Products, Inc.; Albert E. Keleher, Jr., Laboratory for Electronics; Leonard G. Walker, Raytheon Company.

Chapter secretary is William A. Melanson, Cambridge Thermionic Corp., and treasurer, Vernon T. Adams, Western Union.

Directors of the chapter are: Louis J. Dunham, Franklin Technical Institute, immediate past president; Robert B. Richmond, General Radio Company; Fred E. Moran, Western Union; Colonel John D. Evans, Jr., U. S. Army Signal Corps; J. Roy Wolfskill, consultant engineer.

Fort Monmouth

Colonel Murry A. Little, director, Armed Services Electro-Standards Agency, was elected chapter president, succeeding Dr. Hans K. Ziegler. The annual election of officers preceded the chapter's annual Spring dinner-dance held at Gibbs Hall Officers Club, and was the final event of the chapter's current season.

Elected to serve as vice presidents were: Charles Marsh, Electronic Associates; Harry Ross, Signal Materiel Support Agency, Fort Monmouth; Captain S. E. Edelstein, Jr., USN, deputy director, Electro-Standards Agency; Charles M. Arthur, Westinghouse Corp.; Felix Celli, Signal Research and Development Laboratory.

Thomas Schlitz was reelected treasurer and Melvin F. Werksman as secretary. Both are with the Signal School, Fort Monmouth.

Members of the board of directors are: Major General W. D. Hamlin, Brigadier General C. M. Baer, Brigadier General W. Thames, Brigadier General J. E. Heinrich, USAR, Colonel R. H. Bates, Colonel H. E. Price, Colonel L. M. Reiser, Colonel J. L. Wilson, Jr., Dr. H. K. Ziegler, F. Schiro, R. Davis, J. H. Worth, R. Gilbarte, D. Markham, N. Freeman, W. Doxey, J. Weseloh, G. T. Reeves, J. A. McClung, J. P. Hoffman.

Correction

In the N. Y. chapter photo in June, page 49, Lt. Col. D. A. Brock was listed incorrectly. He is Chief of Plans and Training Division, Signal Section, First Army. Lt. Col. R. C. Koerner, Jr., is Deputy Signal Officer, First Army.

Syracuse

Ernest Brock, principal scientist, Basic Science Laboratory, Research Laboratory, Research Division, General Dynamics/Electronics, Rochester, N. Y., presented an illustrated talk on optical masers at the dinner meeting held May 17 at the Sheraton Syracuse Inn.

As a special event of this meeting students from Syracuse and Cornell Universities and the Manlius School were honored for receiving the 1961 AFCEA Awards.

REGION B2

Cincinnati

Guest speaker at the April 26 dinner meeting was AFCEA national president Benjamin H. Oliver, Jr., vice president, Upstate New York Telephone Company. The meeting, held at the Cincinnati Club, was attended by 40 members and guests.

Mr. Oliver gave a talk on the role of AFCEA in the national communications picture, which was followed by a question and answer period.

A business meeting and election of officers preceded Mr. Oliver's talk. Elected for 1961-62 are: president, Ralph G. Edwards, AT&T; first vice president, J. D. Stuart, IBM; second vice president, Captain Ralph T. Quick, USMC; secretary, George Geick, AVCO Corp.; treasurer, Alain L. St. Cyr, Western Union.

Dayton-Wright

The chapter has elected the following officers for the 1961-62 year: Allan F. Schmahl, president; E. C. Hill, executive vice president; Miss Marlene P. O'Neal, secretary; Jim Brennan, treasurer. Vice presidents are Charles Kovac, Roland Clark, Lieutenant Colonel J. Schloss, Ruby Brothers, Milan Filcik, Colonel H. E. Johnson, Colonel T. J. Cummins, Jr., Lieutenant Colonel S. J. Wisniewski.

At a joint meeting held in conjunction with the Wright Brothers Chapter of the Armed Forces Management Association April 26, former AFCEA president Benjamin H. Oliver, Jr., spoke to approximately 100 members and guests.

Mr. Oliver told his audience that the electronics industry is changing faster than people in the industry realize. He pointed out to the members the importance of keeping up with the changes to fulfill their responsibility of liaison between industry and the military.

He traced the growth of electronics from 40 years ago when he became interested in amateur radio. "At that time," Mr. Oliver said, "there were only two scheduled broadcast stations in the entire country, KOA, Denver, and KDKA, Pittsburgh. Now look at radio and television."

Pittsburgh

Chapter president Dick Creps arranged for a tour of the Western Electric plant where telephone equipment is built, engineered and reconditioned. This dinner and tour were held May 24.

REGION C

Cape Canaveral

A dinner meeting with ladies was held May 18 at the Officers Club, Patrick Air Force Base. Sixty-one members and guests attended. Special guests were Dr. R. A. Ibison, Electronic Communications, Inc., St. Petersburg, Fla., who was guest speaker and Denton Clark, supervisor, RCA Missile Test Project, Cape Canaveral.

Since Dr. Ibison's subject was a space flight simulator built by his company as a youth project, about 25 high school students from Melbourne High School and Cocoa High School were present as guests of the chapter.

Dr. Ibison gave an illustrated lecture. He said that the simulator was built on a very low budget and has proved to be very valuable in the instruction of students in the theory and operation of actual space flight.

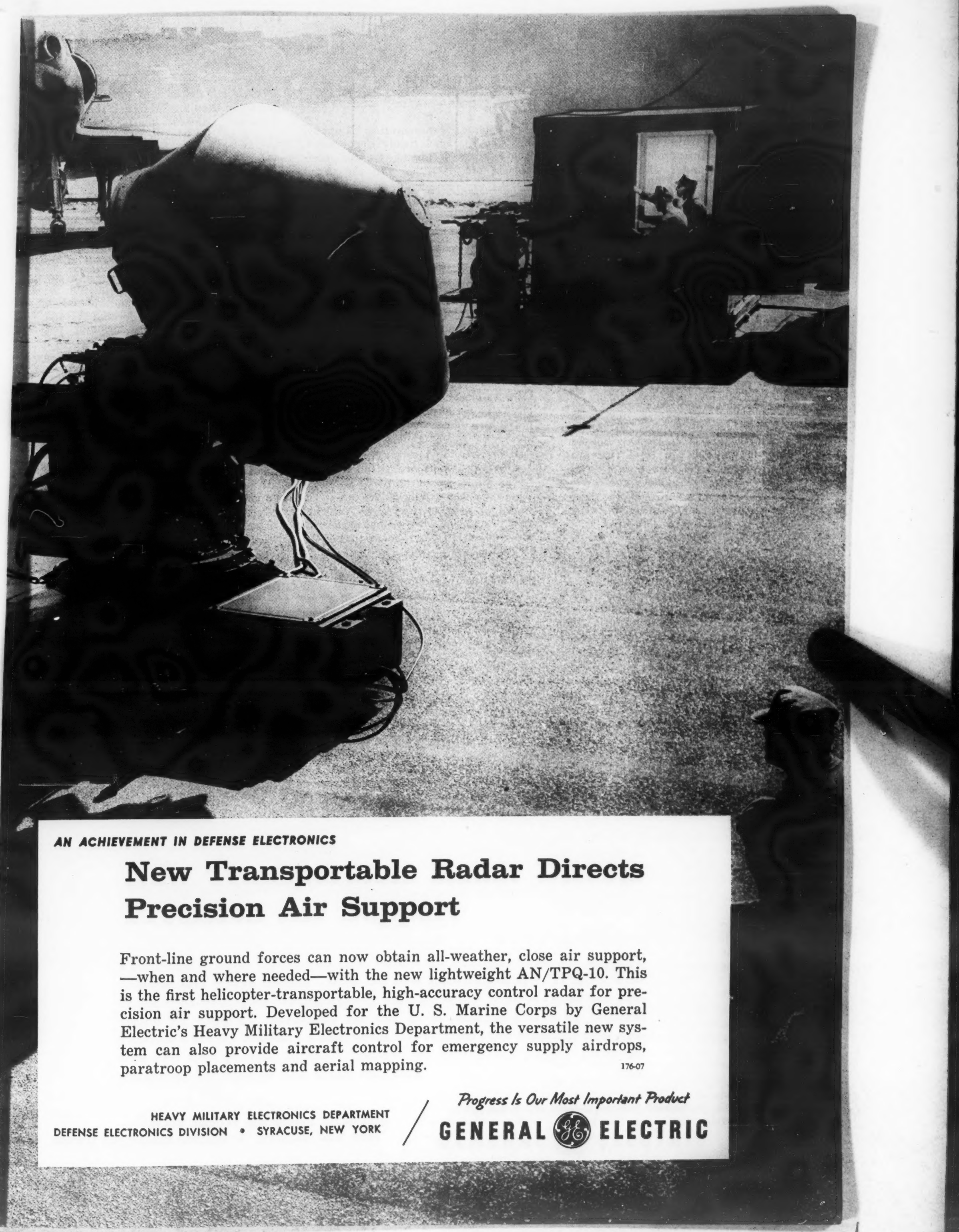
Also at the meeting the new chapter officers were introduced. Lieutenant Colonel Kelly, retiring president, turned the gavel over to George Meredith, newly elected president.

Louisiana

A dinner meeting was held May 31 at the Commissioned Officers Mess, Camp Leroy Johnson. Guest speaker Lieutenant Colonel Charles W. Erdmann, director, New Orleans Civil Defense, discussed plans for civil defense in the New Orleans area.

Colonel Erdmann was appointed to this position and took office on May 1, 1961. Prior to the appointment he was aide to the mayor since 1956. He was a company commander on Guadalcanal during World War II and presently directs the infantry branch school at Camp Leroy Johnson.

(*Continued on page* 46)



AN ACHIEVEMENT IN DEFENSE ELECTRONICS

New Transportable Radar Directs Precision Air Support

Front-line ground forces can now obtain all-weather, close air support, —when and where needed—with the new lightweight AN/TPQ-10. This is the first helicopter-transportable, high-accuracy control radar for precision air support. Developed for the U. S. Marine Corps by General Electric's Heavy Military Electronics Department, the versatile new system can also provide aircraft control for emergency supply airdrops, paratroop placements and aerial mapping. 176-07

HEAVY MILITARY ELECTRONICS DEPARTMENT
DEFENSE ELECTRONICS DIVISION • SYRACUSE, NEW YORK

Progress Is Our Most Important Product

GENERAL ELECTRIC

Middle Georgia

A dinner meeting was held May 22 with 40 members and guests attending. Following dinner, reports were given on the Membership Committee, and Arrangements Committee. Joe Andrews, Elmer Adams, and J. D. Walker were appointed members of the Finance Committee.

The program for the evening was presented by Major Robert Hill, 4137 STRAT Wing, Robins Air Force Base, Georgia. A movie was shown outlining the part SAC plays in our National Defense.

South Carolina

The last meeting of 1960-61 year was held April 21 at Fort Jackson, Columbia, S. C. There were 78 members and guests present. Regional vice president W. K. Mosley presided during the election of officers.

Those elected for the 1961-62 year are: president, H. L. Lackey, Southern Bell Tel. & Tel. Co.; first vice president, Major H. W. Powell, Shaw AFB; second vice president, Joe Winn, General Tel. Co. of the Southeast; secretary-treasurer, Kenneth Hora, Southern Bell Tel. & Tel. Co.

Directors of the chapter are; General H. D. Ives, W. G. Edwards, Captain C. H. Witten, F. K. Shealy, J. P. Fleming, W. R. Knight, J. E. Butterworth, General Mark Clark, L. S. Liles, C. C. Young, J. C. Freeman, Z. V. Beck, J. C. McPherson, Jamor Frank Barnes, Major A. C. Krajnik.

C. B. Culbertson, state director of Civil Defense, introduced guest speaker Major General H. D. Ives, commanding general, Fort Jackson. He spoke on "Esprit," and how the spirit was instilled in his men to become good soldiers and good Americans.

REGION D

Tinker-Oklahoma City

Speaker at the May 18 meeting was Tom Brett, Civil Defense director for Oklahoma. Twenty-seven members and guests attended the meeting.

Mr. Brett's talk was concerned primarily with the responsibilities and problems of civil defense. He emphasized the necessity for the military, as well as the higher government officials to take cognizance of the needs of the public in the event of a disaster. A question and answer period followed his talk.

The results of elections of officers for the coming year were announced. Those elected are: Bill Cook, president; Professor Ansel Challenner, first vice president; H. E. Dooley, second vice president; Paul Jones, third vice president; Beryl Green, fourth vice president; Robert E. Davis, secretary; Perry Cain, treasurer.

REGION E

Chicago

Paraplegics Manufacturing Company, Inc., and the Flick-Reedy Corporation, each with new plants, merged their talents and facilities for the April meeting.

Located in Bensenville, a Chicago suburb, the program presented by the two firms began with a tour of the new plant of Paraplegics Manufacturing Company, known as "PAMCO." This company has received recognition for the economic rehabilitation of the physically handicapped. Members and guests saw how disabled people are trained and developed into efficient workers and highly skilled technicians.

A tour of the nearby Flick-Reedy plant with dinner and a meeting in the auditorium followed. The Flick-Reedy Corporation is known for its industrial innovations such as a gymnasium and plant swimming pool for the use of employees and neighbors.

Hosts for the meeting were Dwight Guilfoil, president of Paraplegics, and Frank Flick, president of Flick-Reedy, who gave welcoming addresses. The principal speaker was J. W. Hoekje, chief engineer, Wheaton Engineering Division of Hurleton Incorporated.

The meeting climaxed a week of open house and other festivities celebrating the formal opening of the new Paraplegics factory.

Captain Edward L. Beach, USN, commanding officer of the USS TRITON, the world's largest submarine, spoke of his experiences "Around the World under the Sea" at the May 23 meeting held at the U. S. Naval Electronics Supply Office, Great Lakes.

The author of two best-selling novels about the sea—"Submarine" and "Run Silent, Run Deep,"—spoke to a capacity audience of 235. His talk was illustrated with color films taken by Commander Joe Roberts, USNR, National Geographic Society photographer, during the TRITON's 84-day journey around the world, following Magellan's trail while submerged and undetected. For this achievement, Captain Beach was awarded the Legion of Merit by President Eisenhower, under whom he formerly served as Naval aide.

Captain R. H. Northwood, USN, Commanding Officer of the Electronics Supply Office and a director of the chapter, stated how ESO now controls about 210,000 electronics items valued at 215 million dollars in the Naval Supply System. Through the ingenuity of its research and development programs, industry is adding 800 electronic items a week to the Navy's stock. These items are essential to the maintenance of the increasingly exotic, ever expanding electronic and communications systems for the fleet, he stated.

A pre-dinner tour of the ESO building featured electronic exhibits displayed by Chicago area manufacturers, a demonstration of UNIVAC II and USS-80 automatic data processing systems and the film, "Man and the FBM." Following dinner, guests were entertained by the Bluejackets Choir of the U. S. Naval Training Center, Great Lakes.

Greater Detroit

The May 24 meeting was held at the Michigan Bell Telephone Company. Thirty members and guests attended for a tour and business meeting. The meeting was hosted by W. B. Snell of the AT&T Company.

During the business meeting the following officers were elected: president, Colonel James I. Vanderhoof (Ret.), Bendix Systems Division; first vice president, Brigadier General Lawrence J. Carr (Ret.), Burroughs Corp.; second vice president, Charles R. Tieman, Bendix Systems Division; third vice president, W. B. Snell, AT&T Co.; treasurer, J. H. White, Michigan Bell Telephone Co.; assistant treasurer, H. E. Reavis, Michigan Bell Telephone Co.; secretary, J. R. Saxton, Michigan Bell Telephone Co.; assistant secretary, H. A. Dawson, Michigan Bell Telephone Co.

The tour consisted of a visit through various AT&T Company offices in Detroit with particular emphasis on a demonstration of nationwide television and radio networks as received in the Detroit area, traffic operations, customer Direct Distance Dialing, private line network and microwave and carrier systems.

Scott-St. Louis

The first meeting conducted by the newly elected officers was held May 5 at Augustine's Restaurant with 78 members and guests attending. Retiring president Colonel D. W. Baugher presented the gavel to new president C. W. Evans. Colonel Baugher was presented a gold AFCEA lapel button by chapter secretary Allan L. Eisenmayer.

Captain Joseph J. Gallagher, chief of staff, Metropolitan Police Department, City of St. Louis, Missouri, returned for the third time as guest speaker. He spoke on "Subversive Activities," a subject he first became interested in through assignments to handle problems with Fascist and Communist groups in St. Louis. Today, he is recognized as one of the country's foremost authorities on this subject.

Captain Gallagher's formal presentation was followed by a question and answer session.

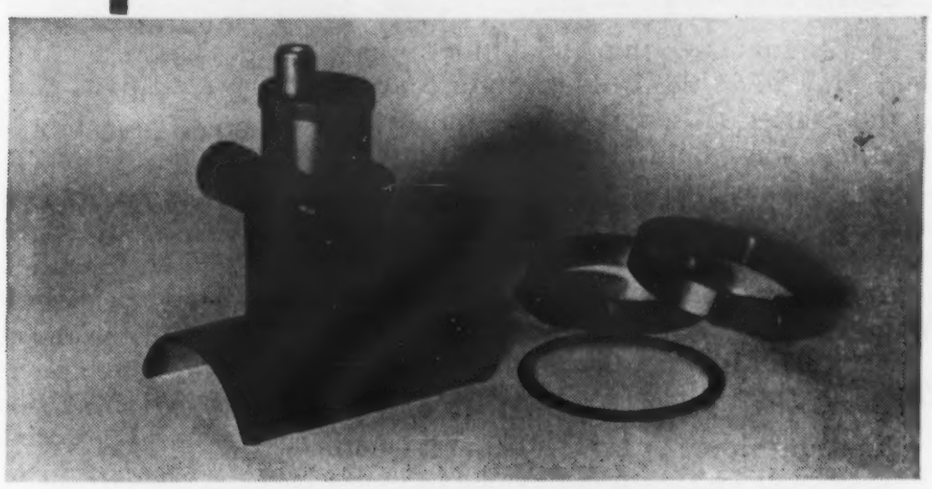
The Annual Couples Dinner-Program-Dance was held June 2 at Augustine's Restaurant. Lieutenant Colonel Joe Beler, USAF (Ret.) presented an illustrated program on the subject of "Global Communications." Prior to his retirement, Colonel Beler's most recent Air Force assignment was in Operations, Headquarters, Strategic Air Command. At present he is associated with Alpha Corporation.

(*Continued on page* 48)

Directional Couplers

with adjustable rf output for rigid coaxial lines and waveguide

- Pressurized and weatherproof
- Easy to install
- Penetration and angle scales for easy coupling adjustment
- Output source impedance matched to connecting cable



By providing an adjustable coupling to external measuring and monitoring equipment, directional couplers by Dielectric facilitate tuning, operating, and maintenance measurements on r-f transmitters, directing and controlling devices, transmission lines, and antenna feed systems. Depending only on the angular orientation, either the incident or the reflected wave may be sampled. Reflectometers for VSWR and net power output measurements require two couplers, one for sampling the incident, the other for sampling the reflected wave.

The r-f output of all Dielectric couplers is directly proportional to line power level at a fixed frequency, and the coupling ratio has a slope of 6 db/octave as frequency is changed. However, compensating networks to maintain the coupler output flat over a specified frequency range can be provided.

Standard couplers for 3⅛" and larger coaxial lines are suitable for any power level and coupling ratio up to four watts coupler output, couplers for smaller lines are limited to one watt output. Waveguide couplers for 1½" x 3" and larger waveguide provide up to 2 watts output, couplers for smaller guide are limited to one watt.

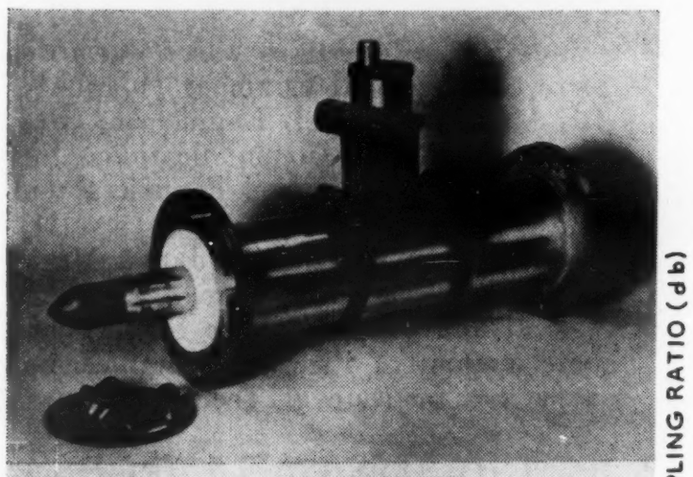
When a d-c output is required, a crystal detector can be supplied for direct attachment to the output jack. A unit comprising a d-c microammeter, reversing and range switches, and variable resistors for calibration is also available.

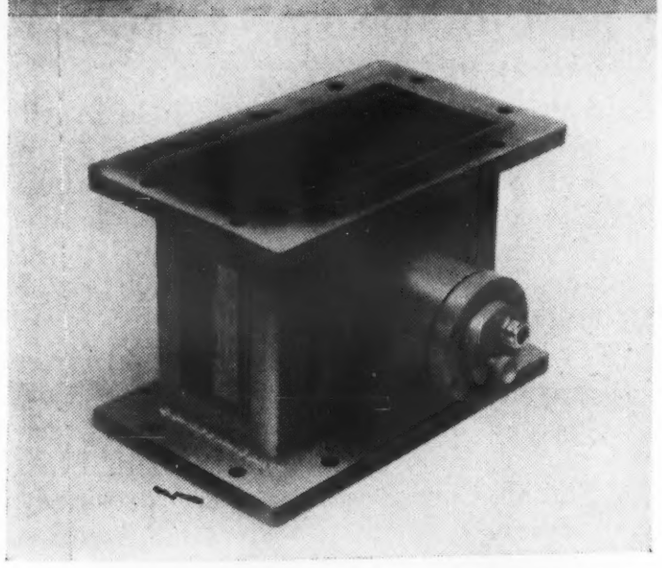
The VSWR caused by a coupler is small, and a direct function of penetration (coupling). At very high coupling ratios, the perturbation is almost unreadable. At maximum recommended coupling, VSWR is less than 1.03.

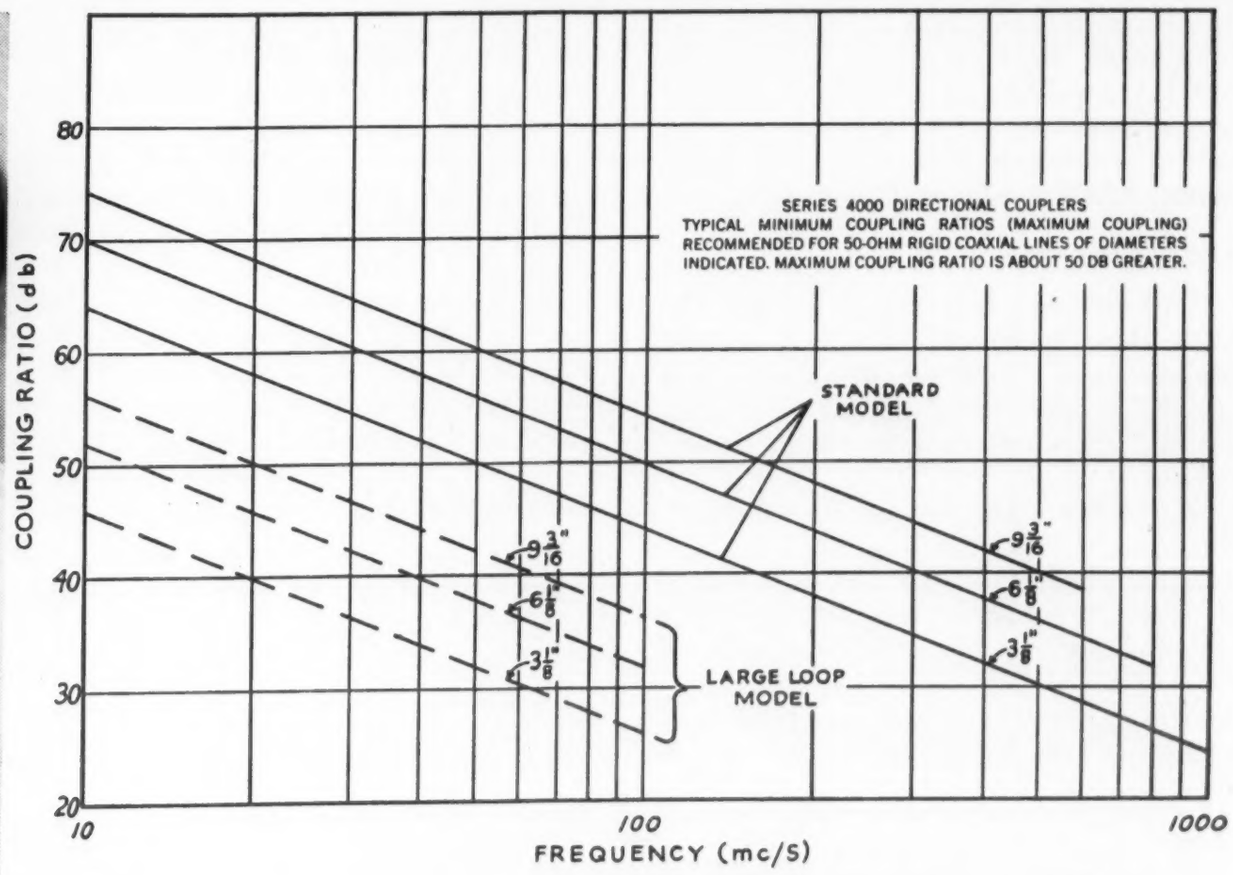
Directivity of standard models is not less than 30 db. On special order, models having a directivity of not less than 40 db will be supplied. The range of coupling ratio is roughly 30 to 80 db, depending on model and frequency.

For further information ask for our directional coupler bulletins. For the answer to specific questions or about special designs, write or call our PROPOSAL ENGINEERING DEPARTMENT.

*For applications in the public entertainment field, DIELECTRIC products are available from the Radio Corporation of America. For all other applications, contact DIELECTRIC directly.







DIELECTRIC'S areas of capability include coaxial, waveguide and open wire techniques . . .
TRANSMISSION LINES & COMPONENTS • NETWORKS
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dial DIELECTRIC for solutions to communications problems.

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RAYMOND, MAINE

REGION F

Greater Los Angeles

The annual meeting and dinner was held May 24 in the Golden State Room of the Statler Hilton Hotel. A business meeting was held following dinner. Guest speaker was Captain W. G. Jackson, Jr., USN, commanding officer, Los Angeles Branch, Office of Naval Research, who spoke on "The Nature and Value of Basic Research."

San Diego

New president of the chapter for 1961-62 will be Captain Burl L. Bailey, commanding officer of Miramar Naval Air Station. Assisting him will be: R. J. Duffield, first vice president; L. A. Cartwright, second vice president; J. C. Orthel, secretary; Commander R. G. Odiorne, USN, treasurer. Directors will be: Captain J. H. Allen, USN, past president; Commander Samuel Freedman, USNR (Ret.); G. A. McDaniel; L. G. Trolese; James Steinhauer; V. M. Abbs; R. J. Parry. All were elected by acclamation.

Outgoing president Allen presided over the meeting which was held at the Midway Chuck Wagon restaurant on May 16. Captain H. C. Maynard, USN was principal speaker. He directs the Pacific Projects Division of the Navy's Operational Test and Evaluation Force. He described methods used by his unique organization in testing and optimizing the effectiveness of equipments and systems to be used by the Navy.

Special feature of the evening was a recorded address to the chapter by AFCEA president Benjamin H. Oliver, Jr. A personal introduction to the talk was presented by W. Earl Trantham, AFCEA national treasurer.

San Francisco

A dinner and briefing at United Airlines Base Cafeteria and tour of the Maintenance Facilities was held May 18. R. J. Armstrong, chief, Communications Services, represented United Airlines.

The Base Maintenance Facilities is the largest maintenance base on one plot of ground in the nation. United is the only carrier with research laboratory facilities capable of testing in the fields of metallurgy, electronics, corrosion, environmental conditions and characteristics. Members and guests also had an opportunity to inspect one of United's most modern aircraft.

Regional vice president Lieutenant Commander Ray E. Meyers (Ret.), gave a short talk endorsing the formation of the Co-operative Interference Committees to assist FCC and the general public in its fight to suppress radio interference.

Seattle

The May 10 meeting was held at the Benjamin Franklin Hotel with 36 members and guests attending. President Roy Pace announced that arrangements had been made for AFCEA Gold Medal Honor Award presentations at the University of Washington and Seattle University.

The following new officers were elected: president, Rear Admiral H. H. McCarley, USN (Ret.); vice president, Commander R. L. Lowe; secretary, W. E. Cruse; treasurer, Lieutenant Commander Raymond J. Shea, USN (Ret.).

Guest speaker for the evening was D. G. Robertson, chapter member, who is radio communications systems design engineer with Boeing Company. He gave an illustrated presentation based on the operation of buried antennae at frequencies below 500 kc.

He pointed out that in an age which has seen hardened underground facilities become commonplace there is a corresponding need for antennae with comparable protection. It was shown that, despite the extreme attenuation of any signals attempting to pass through the earth downward or sideways, that portion of the signal which escapes upwards can be used to advantage. A vertically polarized signal is obtained which, in many respects, resembles the pattern characteristics of a vertical antenna.

PACIFIC REGION

Marianas

The March 28 meeting was held at the Rocker Club, Andersen AFB. The program included dinner and a business meeting.

The April 29 meeting was held at Tarague Beach, Andersen AFB, and was Ladies Night. Following a buffet dinner a short business meeting was held.

H. H. Joiner, general manager, Ocean Cables, was guest speaker at the May 25 dinner meeting held at the Breakers Club, Asan Point. He spoke of the forthcoming submarine cables which will be placed between Hawaii, Midway, Wake, Guam, Okinawa and Japan. Mr. Joiner's talk was augmented by slides and a 14-minute movie.

Philippine

A luncheon meeting was held April 24 at Clark AFB Officers Club. Twenty-nine members and guests attended. Special guests were: David Callahan, vice president, Gilfillan Brothers, Inc.; Brigadier General Bernard M. Wooten, commander, PACAACS; Colonel Frank T. West, director of Operations, PACAACS.

Mr. Callahan, guest speaker, gave a talk describing the concept of Automatic GCA as developed during the period since World War II.

A dinner meeting was held April 28 at the JUSMAG Officers Club, Manila. There were 28 members attending.

The following officers were elected: president, Lieutenant Colonel A. W. Hall, STARCOM; vice presidents, Sherman W. Jones, STARCOM, Lieutenant Commander Loren R. Stiegelmar, NAVCOMFACPHIL, Lieutenant Colonel Armando V. Medel, Chief Signal Officer, Philippine Constabulary; secretary, John C. Behrick, STARCOM; treasurer, William L. Frye, 1961st AACS Group.

Members of the board of governors are: Colonel Howard L. Byerley, 1961st AACS Group; Lieutenant Colonel Robert E. Dougal, Hq. 13th Air Force; Jack Friedman, RCA Communications; Colonel C. S. Carreon, OTCSO, GHQ Armed Forces of the Philippines.

Tokyo

The second annual Awards Presentation Ball was held on May 3 with approximately 90 members and guests attending.

Guests of honor included: Dr. Taro Nishizaki, director general, Radio Regulatory Bureau, Postal Ministry, and Mrs. Nishizaki; Rear Admiral Basil N. Rittenhouse, Deputy Chief of Staff, United States Forces Japan, and Mrs. Rittenhouse; Major General Turner C. Rogers, chief, Military Assistance Advisory Group, Japan, and Mrs. Rogers; Rear Admiral Junji Uozumi, chief, Technical Section, Maritime Self Defense Office, Maritime Staff Office, and Mrs. Uozumi; Major General Yoichiro Hiraoka, Chief Signal Officer, Japan Ground Self Defense Force; Robert J. Boylan, chief, Educational Exchange Branch, USIS, American Embassy, Tokyo, and Mrs. Boylan; Dr. K. Kobayashi, senior executive director, Nippon Electric Company, Ltd., and Mrs. Kobayashi; Lieutenant General M. Kawaminami, Japan Air Self Defense Force, and Mrs. Kawaminami.

Recipients of this year's awards were: Professional Engineer (plaque), Dr. M. Morita, chief, Engineering Department, Radio Communications Industry Division, Nappon Electric Company; Military Communicator (scroll), Captain Ryuji Hiramatsu, Japan Maritime Self Defense Force; Student (scroll and cash), Takuso Sato, graduate student of Electrical Engineering at Tokyo Institute of Technology.

CHAPTERS AT LARGE

San Juan

A business meeting was held April 27 at the Fort Brooke Officers Club with 36 members and guests attending. The order of business included discussion of the chapter project of donating hearing aids to the "City of Silence."

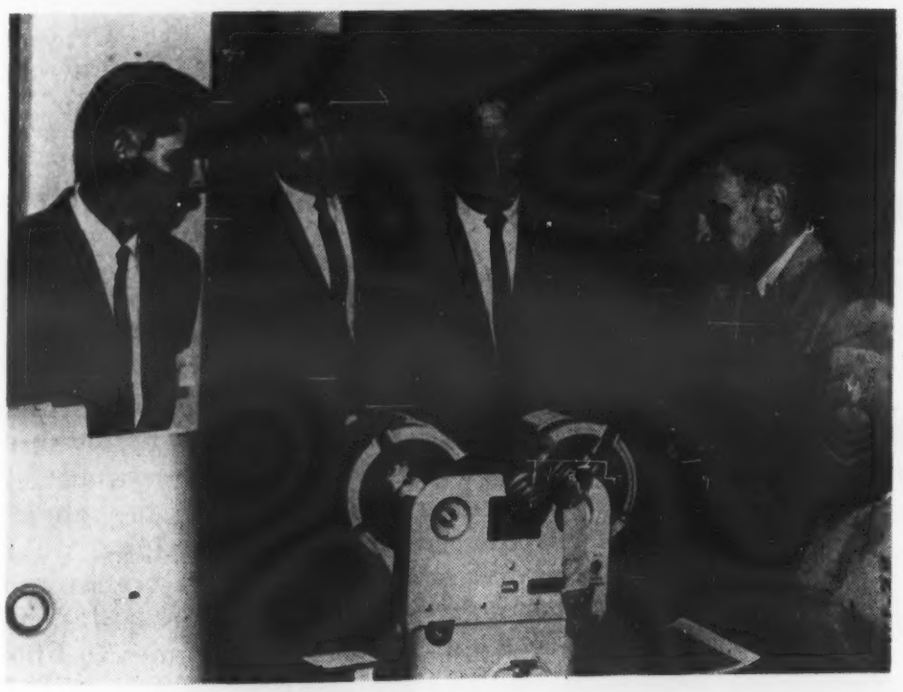
The following officers were elected: president, Walter Siddall, Radio Corporation of Puerto Rico; first vice president, Colonel W. E. Smitherman, USA, Signal Corps; second vice president, George Alich, Federal Aviation Agency; secretary, A. R. Crumley, Jr., Crumley Radio Corporation; treasurer, Jorge Toledo, Radio Corporation of Puerto Rico.

Members of the board of directors are: Lieutenant David Kyle, Luis Diaz Gandia, Eugene Mickel, Jose Rafael Acosta, Robert Peterson.

Fort Monmouth—(photo left) Col. M. A. Little (center) has been named president of the chapter succeeding Dr. H. K. Ziegler (right). At left is Charles Marsh, new first vice president. (photo right) **South Carolina**—Pictured at the April 21 meeting (L to R) W. K. Mosley, regional vice president, H. L. Lackey, newly elected chapter president, and guest speaker Gen. H. D. Ives, commanding officer of Ft. Jackson.

Greater Detroit—Shown during the May 24 tour of AT&T are: (L to R) H. E. Reavis, Mich. Bell Telephone Co.; P. J. Schafer, Detroit Civil Defense; H. C. Nudds, AT&T Co.; H. N. Wasserman, New York Central Railroad; Capt. J. Tillery, USN (Ret.); D. Dauphinais, Bogue Electric Mfg. Co.

Dayton-Wright—(left) Former AFCEA president B. H. Oliver, Jr., vice president, Upstate, New York Telephone Co., at the Dayton Air Force Depot April 26. Others pictured are: (L to R) P. Clark, regional vice president; Col. R. L. Salzarulo; Col. G. E. Harrington, deputy commander, Dayton Air Force Depot.



San Diego—(photo left) C. M. Arndt, senior chief, photographer's mate (right) shows camera and photo equipment used in Composite Photograhic Squadron 63 planes to chapter members who toured the Naval Air Station, Miramar, April 19. (photo right) **Chicago**—Pictured at the April dinner meeting are: ((L to R) H. Bendtsen, Paraplegics Manufacturing Co., Inc.; guest speaker J. W. Hoekje, Hurleton Inc.; chapter president W. L. McGuire, Automatic Electric Co.; J. Reinhardt, Sr., Hurleton Inc.; F. Flick, Flick-Reedy Corp.; D. Guilfoil, Paraplegics Manufacturing Co.

Cape Canaveral—(photo left) At the May 18 meeting, (L to R) retiring chapter president Lt. Col. J. W. Kelly, guest speaker Dr. R. A. Ibison, Electronic Communications, Inc., and B. Hoeper, General Electric Co. (photo right) **Cincinnati**—At the April 26 meeting: (L to R) former AFCEA president B. H. Oliver, Jr.; chapter treasurer A. L. St. Cyr, Western Union; Col. M. K. Peters, Westinghouse; chapter director H. A. White, AT&T Long Lines.

Tokyo—(photo left) Pictured at the second annual Awards Presentation Ball are: (L to R) R. J. Boylan, award winners Capt. R. Hiramatsu, T. Sato, Dr. M. Morita, and chapter president H. F. Van Zandt. (photo right) **Syracuse**—Pictured at the April 12 meeting are: (L to R) R. J. Brown, General Electric; Mrs. Brown; chapter president C. W. Getz, N. Y. Telephone Co.; Col. W. J. Baird, general manager, AFCEA; T. C. Irvine, General Electric; regional vice president R. B. Richmond, General Radio Co.

Association News

Honor Graduate Awards

Eight officers graduating from the U. S. Army Signal School, Fort Monmouth, with top honors were presented the AFCEA Award for outstanding scholastic achievement.

Signal Officer Orientation Course: 2nd Lieutenant David H. Tyrrell, Binghamton, New York, Purdue University; 2nd Lieutenant Michael A. Gutman, Saxonville, Mass., Worcester Polytechnic Institute; 2nd Lieutenant Donald H. Dublin, Decatur, Alabama, University of Alabama; 2nd Lieutenant John R. Rudert, Jr., Warwick, Rhode Island, Rensselaer Polytechnic Institute.

Signal Officer Familiarization Course: 1st Lieutenant Angelo Pecoraro, West Allis, Wisconsin.

Radio Officer Course: 2nd Lieutenant Frank H. Slater, Highland, New York, Gannon College.

Electronic Warfare Analyst Officer Course: Captain Donald P. Dickinson, Murfreesboro, Tennessee.

Electronic Warfare Officer Course: Captain Bobby D. Connor, Hazlet, N. J.

ITT Europe Joins Association

ITT Europe, located in Brussels, Belgium, has joined the Association as a group member. A. G. Williams, manager, Military and Radio Marketing, has been named company representative.

Also named to membership are: Marc A. de Ferranti, president; Martin Kluge, vice president; R. R. Serenbetz, comptroller; J. Bourgeois, director, Telecommunications Marketing; B. Cannon, director, Data Systems; W. J. Schreinemachers, director, Components Marketing; Rex Grey, director, Manufacturing; J. Fulghum, publicity manager; E. Golden, manager, Data Processing; L. Moore, senior manufacturing engineer.

Adm. Quackenbush Awarded SPSE Fellowship

AFCEA is privileged to announce the selection of Rear Admiral Robert S. Quackenbush, Jr., USN, (Ret.), by the Society of Photographic Scientists and Engineers, for a recent Fellowship Award. This award was presented for outstanding achievements in photographic science and engineering.

Admiral Quackenbush has organized and acted as moderator for the Scientific Applications of Electronics in Photography Panel for the 1960 and 1961 AFCEA Conventions. He is well known both in SPSE and AFCEA for his leadership and dedication. AFCEA congratulates "Bob" on this SPSE Fellowship Award.

NEW MEMBERS

Listed below are new members of AFCEA who have joined the Association during the month of May. Members are listed under the chapters with which they are affiliated. Amateur radio operators are listed with their call letters.

Arizona

Mrs. Harriet K. Dennis
Gordon R. Harris

Augusta-Ft. Gordon

Sp-4 R. J. Alkema
2nd Lt. E. A. Autin
2nd Lt. W. E. Biles
SFC E-6 R. Brinson
SFC L. W. Brooks
M-Sgt. H. H. Carney
2nd Lt. F. L. Cornelius
1st Sgt. J. Cuiry
2nd Lt. R. F. Digirolamo
SFC-E7 R. Diglio
2nd Lt. D. H. Dublin
2nd Lt. R. L. Elliott
M-Sgt. T. D. Fields
Capt. Ballard Fleming
1st Lt. R. A. Foster, Jr.
2nd Lt. C. F. Frey
2nd Lt. A. G. Galley
William C. Grimes
2nd Lt. J. F. Hacker
Capt. H. H. Harstein
M-Sgt. R. N. Headrick
2nd Lt. Angel Herrera
Sp-4 R. G. Hill
2nd Lt. H. A. Holley
Sp-6 E-6 C. E. Holmer
2nd Lt. J. F. Joyce
2nd Lt. B. W. Lee, Jr.
Maj. M. J. Lorenzo
M-Sgt. H. D. McCall
Capt. W. C. Marsh
2nd Lt. J. B. Maxwell
CWO L. B. Moore
M-Sgt. J. R. Morris, Sr.
CWO W. L. Mulligan
2nd Lt. S. C. O'Connor
2nd Lt. R. L. Pessini
2nd Lt. H. B. Pritz
William G. Schafer
Sp-5 F. A. Sciortino
2nd Lt. J. L. Stephenson
2nd Lt. Thomas C. Sterr
SFC Harold R. Street
1st Lt. J. F. Sullivan
2nd Lt. W. J. Trail
SFC G. W. Van Deventer, Jr.
2nd Lt. R. P. Vojtko
Lt. Col. C. T. White, USA
Sgt. C. E. Willis

Baltimore

L. G. Horney
T. B. Schillo
Maj. William R. Sell
D. H. Siegfried

Boston

Steven Galagan
Robert V. Howley
Elwood W. Schafer

Cape Canaveral

Robert J. Johnson
B. B. Nelson

Chicago

C. C. Capel
M. L. Donaldson
Roy C. Echols
Maj. N. M. Gertz, USAR
Arthur D. Irwin
M. A. Kassner
R. L. Kearney
Jack W. Lawton
Walter B. Modelski
Frank C. Parsons
R. E. Stoffels
Joseph J. Urban

Cincinnati

Roger B. Dubbs
Col. Merrill K. Peters

Dayton-Wright

Tristram J. Cummins
William K. Fletcher

Ft. Monmouth

Mark D. Bedrossyan
Capt. Aldee G. Miller
Edward G. Schlaefer
Allen H. Stitely
Carroll J. Watkins

Frankfurt

M-Sgt. Clarence H. Walker

Greater Detroit

Col. I. R. Obenchain, Jr.

Greater Los Angeles

Capt. B. L. Bikle, USN
Kenneth A. Collins
Bert Davidson

Gulf Coast

Orville G. Blies
Capt. Oscar C. Duke
Henry C. Horne
2nd Lt. David G. Kanter
Lucian W. Kirks
S-Sgt. Robert M. Neff
Odes E. Robinson
William F. Wathen, Jr.
1st Lt. A. D. Wegner
Capt. Stanley D. West

Hawaii

Lt. (j.g.) W. T. Alexander
WO Warren W. Broome, USN
Michael E. Kuh
Clarence L. Rabideau, Jr.
Robert H. White

Lawton-Ft. Sill

Harold Barclay

Lexington-Concord

Col. R. D. Banker, USAF
Donald I. Higgins
John W. Lazur
Frederick A. Lupton, Jr.
Donald C. Reed
Irwin L. Seidel
Stephen C. Valovic

Lexington

Michael E. Keller
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- **15th Anniversary Issue in September**

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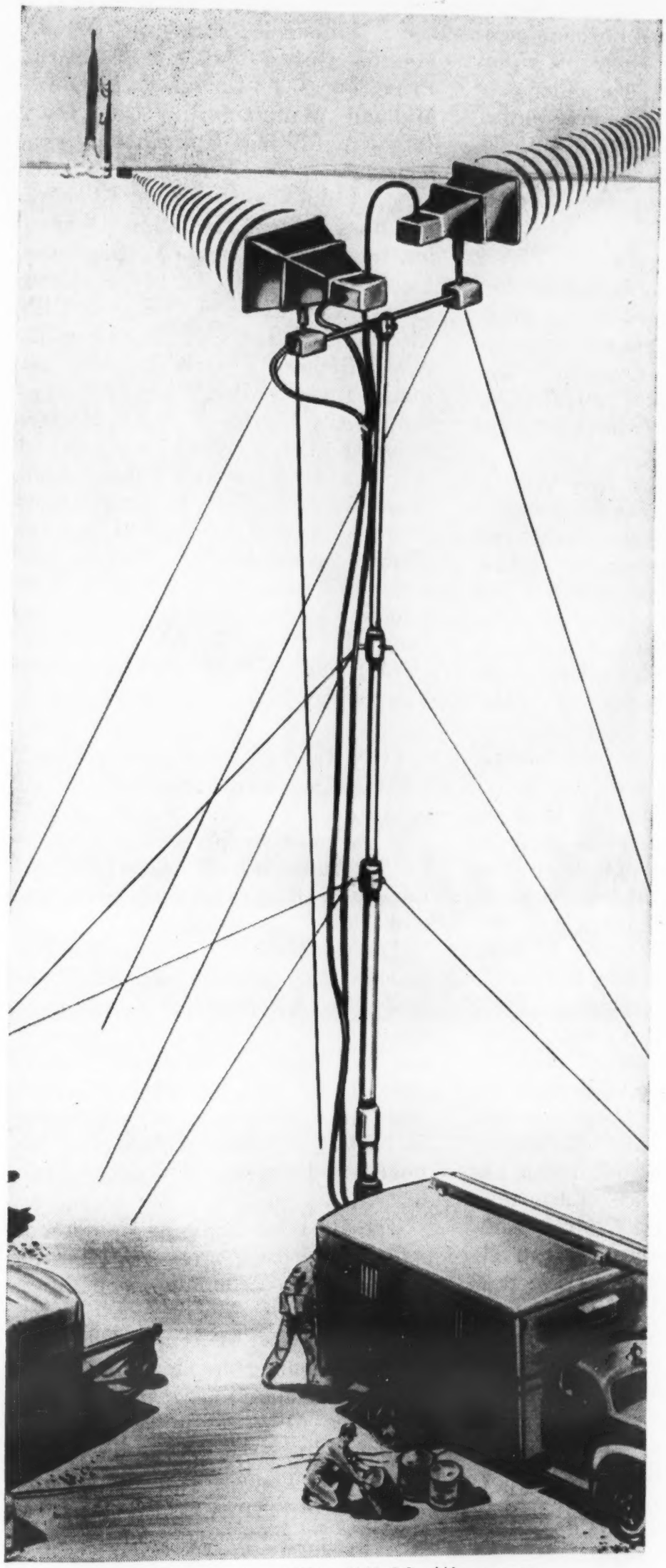
RCA Mobile Microwave



Mobile Station RCA MM-18 Microwave Communication System with portable tower

for Communications where needed... when needed!

Standard MM-18 Microwave packages are available from RCA to provide extremely flexible communications systems for mobile applications. Similar to famous RCA equipment that has been proved in use by over a million channel miles, this MM-18 Mobile System provides a broad radio highway over which many teletype channels and duplex voice channels can be operated simultaneously. The directivity of the radio beam and the multiplexing of the communication channels assure a high degree of security for transmitted messages. Truck-mounted, the portable RCA Microwave System also includes a tower that can be rapidly raised and easily transported from one place to another. RCA Mobile Microwave performance matches the reliability found in fixed stations.

MM-18 Systems Ideal for:

- Remote missile bases.
- Command posts to remote launching pads.
- Command post installations for field maneuvers.
- Siting teams requiring high mobility.
- Emergency installations—Civil Defense.

Experienced Microwave engineers will gladly provide additional information. Contact RCA, Dept. X-291, Bldg. 15-1, Camden 2, N.J. or telephone WOodlawn 3-8000, Extension PC-4560.

Also, New MM-600 Microwave Systems. Long haul, high-density systems for fixed installations. Designed to comply with CCIR/CCITT performance standards. Channel capacity of 600 frequency-division multiplexed voice circuits plus service and alarm channel. Alternately, one r-f channel will accommodate 525-line monochrome television; NTSC color TV or 685 CCIR television.

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RADIO CORPORATION OF AMERICA

NEWS ITEMS AND NEW PRODUCTS

Organizational and functional changes designed to streamline operations within the National Aeronautics and Space Administration headquarters have been made by James E. Webb, Administrator.

Under the new plan, the Office of Programs is established in the Office of Associate Administrator to bring together technical and budgetary review and evaluation in a single office. D. D. Wyatt was named Director of the Office of Programs and will assist the Associate Administrator, Dr. Robert C. Seamans, Jr., in carrying out his agency-wide program management responsibilities. Wyatt was former Assistant Director in the Office of Space Flight Programs.

The Office of Business Administration, headed by Albert F. Siepert, Director, has been redesignated the Office of Administration. This office will continue to report to the Associate Administrator and to perform its previous functions. It will serve as an administrative staff resource for both NASA general management and the technical program offices.

The Office of Administration will also provide direction and assistance to NASA field installations in the performance of administrative functions. In addition it will direct activities of the Western Operations Office, Santa Monica. California.

The Director of the Office of Programs will be in charge of program budgeting and reprogramming, and for the review and coordination of Project Development Plans coordination of facilities planning and construction, and preparation of program reports. The Office of Reliability and Systems Analysis and the Office of Program Analysis and Control will be incorporated in the Office of Programs.

• • •

Representatives of Small Business firms from 17 Eastern states attended the Army Signal Corps Small Business Procurement Conference held last June in Philadelphia. The meeting was the first of three being sponsored throughout the nation by the Army Signal Supply Agency in connection with President Kennedy's request that Government give a greater share of its procurement to small business.

The conferences are to provide guidance to assist small business men in obtaining a larger share of Army Signal Corps contracts. The other two conferences, which will be held in the middle of July at Chicago, Illinois and Pasadena, California, will include small business men from the Midwest and the West.

• • •

A National Defense Executive Reserve Conference, called by the Business and Defense Services Administration of the U. S. Commerce Department last May, was attended by forty-five executives from electronic industries.

The BDSA Executive Reserve is a group of selected businessmen designated to assume executive positions in the Federal Government in the event of a national emergency. The May conference was described as a "shirt sleeve" meeting devoted to typical problems the Reservists would face if called to active duty. In addition, the Reservists were briefed on the latest developments in non-military defense and met with the Secretary of Commerce, Luther H. Hodges, and other top administration officials.

Among the Reservists from the electronic industries who were invited were: Frank E. Baker, Westinghouse Electric Corp.; David L. Bell, P. R. Mallory & Co., Inc.; Harold C. Booth, Bomac Laboratories, Inc.; John A. Bouvier, Jr., Pantex Manufacturing Corp.; Oliver B. Buskirk, Motorola, Inc.; Harold G. Butterfield, Grand City Container Corp.; George D. Butler, International Resistance Co.; Raymond E. Carlson, Bellair Estates, Florida; Bruce Carpenter, American Bosch Arma Corp.; Frank E. Corr, Eitel-McCullough, Inc.; S. R. Corrado, Fridy, Gauker,, Truscott & Fridy, Inc.; Harry A. Ehle, Christianstead, St. Croix, Virgin Islands; Delmus J. Fagge, Potomac Electronics, Inc.; E. Dorsey Foster, Radio Corporation of America; G. Richard Fryling, Erie Resistor Corp.; Lanier Gray, Fairhope, Alabama; Oliver J. Greenway, Belleair, Florida; H. E. Hale, Fairchild Controls Corp.; Noble C. Harris. McLean, Virginia; Carl I. Hollatz, Delray Beach, Florida; Walter F. Joyce, Texas Instruments, Inc.; Kenneth F. Julin, Leach Corp.; Robert B. Kaiser, Moloney Electric Co.; Charles E. Krampf, Aerovox Corp.; Richard B. Leng, Quantatron, Inc.; William P. Maginnis, W. L. Maxson Corp.; Arnold Malkan, Princeton, N. J.; George M. McGrew, Midland Manufacturing Co., Inc.; James A. Milling, Howard W. Sams & Co., Inc.; Dr. Norman H. Moore, Litton Industries, Inc.; Dr. Kennard H. Morganstern, Radiation Dynamics, Inc.; E. T. Morris, Westinghouse Electric Corp.; W. D. Myers, Cook Electric Co.; Louis H. Niemann, CBS Electronics; Sam Norris, Denville, N. J.; Richard T. Orth, Eitel-McCullough, Inc.; R. D. Parker, Washington, D. C.; Carroll M. Rahn, Reeves-Hoffman Div., Dynamics Corp. of America; Glen Ramsey, Fansteel Metallurgical Corp.; A. J. Spriggs, Los Angeles, California; H. Myrl Stearns, Varian Assoc.; Basil S. Turner, Chicago Telephone Supply Corp.; William E. Wilson, Stancor Electronics, Inc.; J. Philip Worth, Stamford, Conn.; and John M. Ziegler, Savoy Electronics, Inc.

• • •

More than 500 executive officers, representing business and industrial organizations of over 60 free nations, will assemble by personal invitation for the International Industrial Conference next September in San Francisco.

The Conference is organized under private auspices and supported entirely by contributions from more than 100 U. S. companies. Sponsors are the National Industrial Conference Board and Stanford Research Institute. Conference chairman will be Neil H. McElroy, chairman of the board of Procter and Gamble Company.

The 1961 International Conference will explore such areas as trade, investment and economic cooperation among nations, covering, for example, emergence of regional trading blocs, economic implications of intensified competition for markets, and pressures of rising populations for higher living levels. Solutions will be sought for management and organizational problems involved in expanding business enterprises, domestic and foreign. Means will be discussed for the provision, training, and development of strong and enduring leadership essential to the successful conduct of business enterprises throughout the world. The effects of science and technology on

MIL/SPEC
GM-07-59-2617A

...Implemented by Capehart's INTERDICT GROUP

A veritable thicket of specifications has grown up around radio frequency interference measurements. Specification GM-07-59-2617A appears to be one of the thorniest. If you are having problems implementing this, or are experiencing any other difficulty connected with RFI, contact the INTERDICT Group from Capehart.

INTERDICT (for Interference Detection and Interdiction by Countermeasures Team) is a unique service. It began with the numerous field studies our engineers were carrying out. It grew into a series of mobile RFI measurement vans, an expanded force of engineers, a manual on RFI prediction by mathematical procedures, cognizance of all current military and industrial communications/electronic equipment, and formal organization into a team led by Dr. Joseph Vogelman, widely-known authority on RFI detection and elimination.

The engineers from INTERDICT are completely competent to aid in establishing: systems analysis, design limitations, criteria and test procedures. Follow through by INTERDICT engineers in the actual performance of these tests assures complete implementation of GM-07-59-2617A or any other relevant MIL Spec*. They have performed numerous systems and site analyses resulting in the prediction, detection and elimination of interference at such complex sites as Cape Canaveral and Vandenberg AFB, frequently before r-f interference occurred. They can offer you studies of this magnitude, or of very limited application, depending on your needs. INTERDICT possesses the men, the vans, the materiel, and the experience to analyze a complete proposed missile system, an individual site, or a single piece of installed equipment. The "package" can be tailored to the requirement.

The INTERDICT Group analyzes a proposed system for all r-f radiation sources, makes the necessary field measurements, predicts and determines the causes of interference, and recommends the proper remedial action. Should this latter require any equipment not commercially available, Capehart's quick-reaction engineering and model shop can provide what is needed very rapidly.

Capehart's INTERDICT offers the first world-wide packaged service to analyze and counteract radio frequency interference. It also provides for elimination of electromagnetic radiation hazards to personnel and materials such as squibs, ammo, fuel. All service is performed in compliance with applicable MIL Specifications such as that noted. To avail yourself of these unusual services, contact:

*Such as MIL-I-26600, I-6051, T-9107, S-10379, etc.

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world economic growth will also be investigated.

Conference headquarters until September will be at SRI in Menlo Park, California, and eastern headquarters at the National Industrial Conference Board, 460 Park Ave., New York City, N. Y.

• • •

A contract to achieve greater compatibility of electronics systems aboard a Naval vessel has been awarded to Hazeltine Corporation by the U. S. Navy's Bureau of Ships. The contract covers the design of a coordinated electronics system for a guided missile ship (DEG).

Associated with Hazeltine in this effort are Newport News Shipbuilding and Dry Dock Co., Sperry Rand Corporation and Development Engineering Co., as subcontractors.

According to Rear Admiral R. K. James, Chief, Bureau of Ships, this is the first attempt by the Navy to merge naval architecture and electronic systems engineering in the initial designs of ships. The new approach should achieve optimum performance of shipboard electronics systems in relation to one another and the ships' environments. The feasibility of an integrated electronics approach to a solution of the shipboard problem has been under study by Hazeltine for some time, Webster H. Wilson, Hazeltine president, noted.

The program will proceed in four steps, as follows: A proposed whole ship electronics system, including structural, installation and maintenance aspects will be developed; Recommendations for modification, procurement and development requirements in support of the above will be submitted; Cost and value analysis of the system will be submitted; and, Schedule of feasibility analysis will be submitted.

According to Mr. Wilson, Hazeltine will be responsible for systems integration and coordination of the over-all activities of the program. The basic electronic equipment and system studies will be conducted by Hazeltine and Sperry Rand. Newport News Shipbuilding and Dry Dock Co., will be charged with the primary responsibility for investigating structural design and installation problems. Development Engineering Co. will survey antenna engineering and installation problems.

• • •

The world's longest point-to-point microwave beam for television relay service last May began carrying programs 136 miles in a line-of-sight be-

tween mountain peak relay stations in the Idaho-Utah border. The system relays network programs from a 9,000 foot peak near Salt Lake City across the length of Great Salt Lake and through a mountain pass to a receiving point on Albion Peak in Idaho. From there a connecting microwave link flashes the signal to the transmitter site of Station KID-TV, Idaho Falls.

Designed by the Radio Corporation of America, the system is the "longest line of-sight microwave transmission ever accomplished for TV relay."

A dish-shaped parabola antenna, 10 feet in diameter, transmits the signal from Coon Peak in the Oquirrh Mountain Range, six miles from the Great Salt Lake shoreline. In a single hop, the beam traverses the entire length of the lake, crosses salt flats at the north and slices through a 5,400 foot mountain pass to reach the receiving point, some 7,000 feet high. The system makes use of RCA's new TVM-1B microwave relay equipment.

Normally relay stations cannot be located more than 25 to 30 miles apart because the microwave signal requires an unobstructed line-of-sight.

• • •

Direct amplification of sound waves using microwave radio energy as a power source has been demonstrated by Dr. Edmund B. Tucker of the General Electric Research Laboratory. Amplification of the sound waves, called phonons, is accomplished by stimulated emissions of energy by atoms as they change from a higher to a lower energy level. This is the same mechanism used in the Maser to amplify electromagnetic radiation and the new phenomenon has been termed the phonon Maser effect.

According to Dr. Guy Suits, G.E. vice president and director of research, this is the first time that stimulated emission has been successfully used to amplify energy other than electromagnetic energy.

In the new phonon Maser effect, individual atoms are raised to a high energy state by irradiating them with high frequency electromagnetic energy. Then, when signal energy of a lower frequency is introduced, stimulated emission of the signal frequency occurs. Under the proper conditions, the stimulated emission may be strong enough to produce amplification of the signal. In the Maser, the pump, signal and output are all electromagnetic energy, whereas in the phonon Maser effect only the pump is electromagnetic energy—the signal and output are both mechanical, or sound, energy.

The effect has been demonstrated with short pulses of very high frequency (9.3 kilomegacycle) sound in a ruby crystal. Ruby consists of alumina with chromium ions as an impurity. When it is subjected to a magnetic field, the electrons on the chromium ions, acting as small magnets, tend to line up with the field. Each electron has four characteristic energy levels, corresponding to how closely it lines up with the applied field. Most of the electrons are in the lowest energy level, but can move to higher energy levels by absorbing energy at a certain resonant frequency, which is set by the magnetic field strength and the characteristics of the electrons in the crystal. The reverse transition, from a high to a low energy, can be made by emission of energy at the resonant frequency.

There is also interaction between the vibrations of the atoms in the crystal lattice and the energy states of the electrons, due to the electric fields of the atoms in the lattice. As the atoms vibrate, the electric fields acting on the electrons vary and this affects their energy levels. This interaction is what makes the phonon Maser possible, and Dr. Tucker's work permits it to be observed directly and measured accurately for the first time.

To achieve amplification by the phonon Maser effect, as in the conventional Maser, most of the electrons are raised two energy levels above the lowest by pumping with electro-magnetic energy at a frequency which causes this transition (23 kilomegacycles in this case). Then, when energy at a lower frequency is introduced, simulated emission occurs.

• • •

The first link of an intersite communications system at the Atlas missile squadron, Schilling Air Force Base, Kansas, has been completed on schedule, according to General Telephone & Electronics Corporation. The initial communications link connects an Atlas missile launch complex with a squadron command post at Schilling.

According to Richard W. Couch, manager of the Systems Engineering and Management Operation of Sylvania Electric Products, Inc., "The buried, blast resistant inter-site communications system will ultimately

join 12 launch complexes to the central command post which will be linked to the Strategic Air Command alert system."

The fully integrated inter-site systems employ Lenkurt 45BN carrier communications equipment at command posts and terminal locations. Lenkurt is responsible for engineering the communications system and supplying power and multiplexing equipment. Transistorized repeater equipment located along cable routes amplifies transmission of voice or data signals between terminals.

Telephone cable utilized within the system will be supplied by General Cable, while Ets-Hokin & Galvan is responsible for installation of cable and carrier equipment. Site managers from the Product Support Organization of Sylvania Electronic Systems are responsible for field engineering direction.

• • •

Three Frenchmen at Toulouse have built a powerful electronic microscope, according to *France Actuelle*, a report for Americans on modern France and the French Community published by the Comité France Actuelle, a private association of French businessmen.

The four-ton, ten-foot high instrument has taken clear and "astonishingly beautiful" pictures of living bacilli measuring only twelve millionths of an inch. With previous electronic microscopes, cell walls of living biological specimens burst, so that only dead objects were observed and photographed. In the successful photographing of living bacteria, the traditional slide is replaced by a slide cell forming a small, airtight box, with a volume of about one-tenth of a cubic centimeter. The biological material is placed in this box, which then is closed by two very thin windows less than one-tenth of a micron thick. These windows are transparent to the electrically accelerated electrons and are strong enough not to burst in a vacuum.

Gaston Dupouy, Honorary General Director of the National Center for Scientific Research, and a well-known pioneer in the field of electronic optics, is one of the creators of the powerful microscope. Assisting in its construction were Professor F. Perrier and Engineer L. Durrieu.

The electronic microscope has four lenses, one of them weighing a ton and will be capable of operating at voltages up to 1.5 million, *France Actuelle* reports.

It will be possible to observe and photograph all the life stages of a

bacterium enlarged 50,000 times the developers believe.

According to Dr. Dupouy, "With this apparatus we believe that one day we will be able to photograph the interior of a molecule—that is to say, penetrate into the secrets of the tiniest portion of any substance. And thus we would be taking a great step forward in our knowledge of the structure of matter."

• • •

Page Communications Engineers, Inc., has designed and is providing a completely mobile tropospheric-scatter communications system for the Air Force. Designated the AN/MRC-85, each dual 10 kw, all environment, vanized, tropo station comprises two 4-wheel trailers, with a 28-foot paraboloidal antenna mounted on each, and three 2-wheel semitrailer equipment vans. The stations, for Air Force use overseas, are being assembled by Adler Electronics and ITE Circuit Breaker Co. under subcontract from Page.

Two of the semitrailer vans house and transport dual 10 kw transmitters and associated equipment, parametric amplifiers, quadruple-diversity receivers, exciters, performance test equipment, voice and telegraph multiplex, signaling equipment, wire distribution frame, storage area, maintenance facility, transmitting and receiving filters with associated waveguide and heating and air-conditioning units.

The third semitrailer houses two 150 kw diesel generators and associated switching equipment. This plant provides primary power with 100% standby to operate the terminal. It is designed to use commercial power where available.

• • •

New preflight checkout techniques for the Saturn space vehicle will be sought in a NASA study utilizing a digital computer. The Saturn team will simulate preflight checkout on the computer in an effort to reduce the time element and insure higher reliability in checking out the multi-engine vehicle with its attendant maze of mechanical and electrical equipment.

The study will be conducted with a Libratrol 500 Computer Control System developed by the Librascope Div. of General Precision, Inc. The Libratrol 500 is a general-purpose digital computer control system in commercial and military use. Its operation is serial, single-address, binary fixed point, with internally stored program. Memory capacity is 4096 words. The input rate is 75 data words of 31-bit length per second.

Included in the system are a voltage-to-digital converter: commutator unit capable of handling 120 transducer signals; and a Flexo-writer for interrogation, command input and print-out.

• • •

A navigational training system to be used in conjunction with other systems and designed to simulate actual Polaris missile firing missions has been installed at the U. S. Navy Sub school in New London, Connecticut. The simulator, an accurate reproduction of the complex navigational center and ships control center in the submarine *George Washington*, is designed to provide operational and environmental training under realistic mission conditions.

Developed and built by Reflectone Electronics, Inc., Stamford, Conn., in close association with Electric Boat Company, Division of General Dynamics, for the U. S. Navy under contract with the U. S. Naval Training Devices Center, Port Washington, New York, the simulation system is part of one of the largest and most complex training systems ever constructed.

Designated the Polaris (FBM) Navigation Center Device X21A37, the Reflectone system is designed to be operated in conjunction with complex diving and missile launching simulators housed in the same building. The complete training installation may be used to train a portion of the ship's complement as an integrated crew in certain phases of Polaris operation for missile count-down and firing. The navigational portion permits maneuvers to different parts of the globe.

The Reflectone navigational training system consists of three sections —the actual navigation center, the instructor's console and the computer room. The navigation center contains actual equipment, mockups and realistically simulated operational equipments exactly as aboard the submarine. Included are control consoles, SINS systems, NAVDAC control, periscopes and controls and recorders. Radio aids, transmitters and receivers, plotters, chronometer and Loran C are part of the system, as well as duplications of all indicator lights.

The computer room houses the heart of the simulator system, the logic equipment that supplies information parameters, compares relationships and feeds data to the navigation center. These equipments include computers to develop latitude,

longitude, ships ground speed and ocean current velocity.

Tied in with an artificial star sky are a star selection computer and data selector for the type 8 periscope. A star azimuth and altitude computer, latitude resolver, local hour angle computer and aries computers are employed for the type 11 periscope. Additional computation equipment provides sky information and precise star position data, with specific error computers related to each.

Serving as an integral part of the training center, a course generator developed by Reflectone engineers provides an actual position of the vessel for use in the navigation problem, against which the system errors can be measured. Controlled by the instructor, or the diving trainer the course generator produces mechanical and electrical signals representing speed and heading of the vessel together with ocean current characteristics in both direction and speed to provide a simulated location of the submarine relative to the face of the earth.

Particularly noteworthy in the trainer is a realistic simulation of the periscope systems aboard the *SSBN George Washington*. These include a type 8 periscope for celestial observation and a type 11 star tracking periscope. The student can observe clouds and constellations through the type 8 by means of a low cost simulation mechanism.

• • •

Tests to measure the performance of "Ballute," a system for recovering missile equipment at speeds 10 times faster than sound (Mach 10) and altitudes as high as 155,000 feet, are scheduled to begin soon at Holloman Air Force Base, Alamagordo, N. M.

Initial tests will determine capabilities of the balloon-type drag recovery system at altitudes between 60,000 and 155,000 feet, according to Goodyear Aircraft Corp., which developed the system. A 1,000,000 cubic foot stratospheric altitude balloon will be used to haul the drag device to 100,000 feet.

A second series of tests at Eglin Air Force Base, Valparaiso, Fla., will see Cree test missiles launch the system at 155,000 feet at speeds ranging from one and one-half to four times the speed of sound. At peak altitude, the task of the system will be to recover the test missile's 500-pound third stage. A final group of tests, at a site still to be disclosed, will measure the system's performance at speeds ranging from four to 10 times the speed of sound.

Accumulated test results will be used in developing recovery systems for booster assemblies, nose cones, research vehicles, data capsules and emergency escape capsules, which soar as high as 200,000 feet at speeds as high as 10 times that of sound.

GAC is conducting the tests under a contract with the Parachute Accessories Laboratory, Decelerator Branch, of the Air Force Systems Command's Aeronautical Systems Division.

• • •

Last spring, a group of Navy "Hams" requested and was given permission to operate an amateur radio station from Kure Island during the American Radio Relay 27th Annual International DX contest. This contest consisted of two weekends devoted to CW operations and two weekends devoted to SSB operations.

The Hams took leave and traveled to this isolated Pacific island each weekend during the contest. The Federal Communications Commission assigned the call KH6ECD for the group and the ARRL granted "new country" status to the Island. KH6ECD was on-the-air for 168 hours during the four weekends. A total of over 3500 contacts was obtained with all parts of the world and every state was worked except one.

Lt. Comdr. W. M. M. Robinson, MC, USN, (KM6BQ) was in charge of the operations. The ARRL station W1AW assisted with publicity through frequent announcements. A preliminary report received from Lt. Comdr. Robinson indicates that as soon as the group started transmitting it was besieged with stations seeking a contact.

SSB transmissions were carried over 7,205; 14,300; 21,400; and, 28,650 kilocycles while CW transmissions were on 7025, 1450, 2150 and 2850 kilocycles.

• • •

International Industrial Development Center, Stanford Research Institute, has released a staff paper recommending a network of international cooperation in research on problems of newly developing countries.

The paper, *Scientific Research and Progress in Newly Developing Countries*, reports on the deliberations of a volunteer study group which included more than 40 scientists, technologists and research administrators. The authors of the paper are Eugene Staley, research director of SRI's International Industrial Development Center and David C. Fulton, Manager of public affairs.

The paper recommends the estab-

lishment of an Office of Research and Development within the U. S. international aid program to help define research needs of newly developing countries, to carry out studies on the theory and methods of development, and to support long-term relationships between institutions in the U. S. and those in the newly developing countries.

The paper also suggests actions that might be taken by foundations, the United Nations, private industry, development agencies in the newly developing countries themselves, and scientists and scientific institutions in the United States.

Copies of the paper are available at $3.00 each from Department 300, Stanford Research Institute, Menlo Park, California.

• • •

System Development Corporation (SDC) and two branches of the Office of Naval Research will co-sponsor a conference on *Application of Digital Computers to Automated Instruction*, to be held in Washington, D. C., October 11-13, 1961.

Representing ONR will be the Personnel and Training Research Branch and the Information Systems Branch. Dr. Glenn L. Bryan and Comdr. Vance R. Wanner of ONR and Dr. Launor F. Carter, of SDC, are Co-Chairmen for the 3-day meeting. The sessions will be held in the Department of Interior auditorium on C Street, between 18th and 19th Streets, N.W.

The program will consist of invited papers by individuals representing organizations and institutions engaged in pertinent research and educational activities.

Attendance is open to all interested technical personnel. Further information and a preliminary program, when available can be obtained by contacting Washington Liaison Office, System Development Corporation, 1725 Eye Street, N.W., Washington 6, D. C.

• • •

Northeastern University has announced a new Doctoral Program in Electrical Engineering based on its current Cooperative Masters Degree Program. The program will require four years beyond the Baccalaureate Degree and will consist of three years of Cooperative assignments in industry involving two ten-week terms in class and a ten and twenty-two-week term in industry each year, followed by one full year of resident research at the University. The first two years alone will qualify the student for a Masters Degree in Engineering. The Cooperative Masters Degree Program is also offered in Civil, Mechanical and Chemical Engineering.

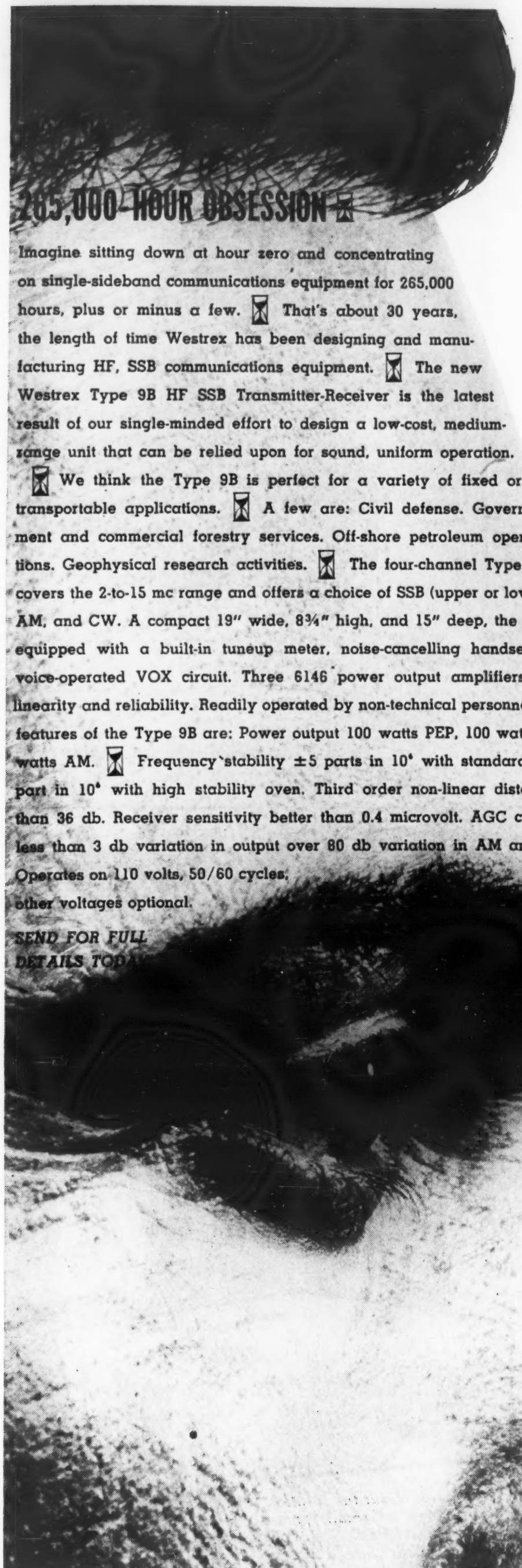
Northeastern was the first University to develop Cooperative Education at the Graduate level. The programs are coordinated by Lt. Col. Alvah K. Borman of the Boston AFCEA Chapter. For further information write to Professor A. K. Borman, Coordinator of Graduate Cooperative Education, 253 Richards Hall, Northeastern University, Boston 15, Mass.

• • •

Current Developments in Automatic Data Processing Systems will be the theme of the Eighth Institute on Electronics in Management to be held at The American University, Washington, D. C., from October 30-November 3, 1961.

Sponsored by the School of Government and Public Administration of AU, the Institute is designed for management personnel, both line and staff, from government, business and industry, particularly those who are engaged in planning or using automatic data processing systems.

To enroll or to request further information, write to Dr. Lowell H. Hattery, Director, Eighth Institute on



265,000-HOUR OBSESSION

Imagine sitting down at hour zero and concentrating on single-sideband communications equipment for 265,000 hours, plus or minus a few. That's about 30 years, the length of time Westrex has been designing and manufacturing HF, SSB communications equipment. The new Westrex Type 9B HF SSB Transmitter-Receiver is the latest result of our single-minded effort to design a low-cost, medium-range unit that can be relied upon for sound, uniform operation.

We think the Type 9B is perfect for a variety of fixed or transportable applications. A few are: Civil defense. Government and commercial forestry services. Off-shore petroleum operations. Geophysical research activities. The four-channel Type 9B covers the 2-to-15 mc range and offers a choice of SSB (upper or lower), AM, and CW. A compact 19" wide, 8¾" high, and 15" deep, the set is equipped with a built-in tuneup meter, noise-cancelling handset, and voice-operated VOX circuit. Three 6146 power output amplifiers insure linearity and reliability. Readily operated by non-technical personnel. Other features of the Type 9B are: Power output 100 watts PEP, 100 watts CW, 25 watts AM. Frequency stability ±5 parts in 10^6 with standard oven, ±1 part in 10^6 with high stability oven. Third order non-linear distortion better than 36 db. Receiver sensitivity better than 0.4 microvolt. AGC characteristic less than 3 db variation in output over 80 db variation in AM and SSB input. Operates on 110 volts, 50/60 cycles; other voltages optional.

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RESULT:

THE NEW WESTREX 2-15 MC SINGLE SIDEBAND TRANSCEIVER

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• • •

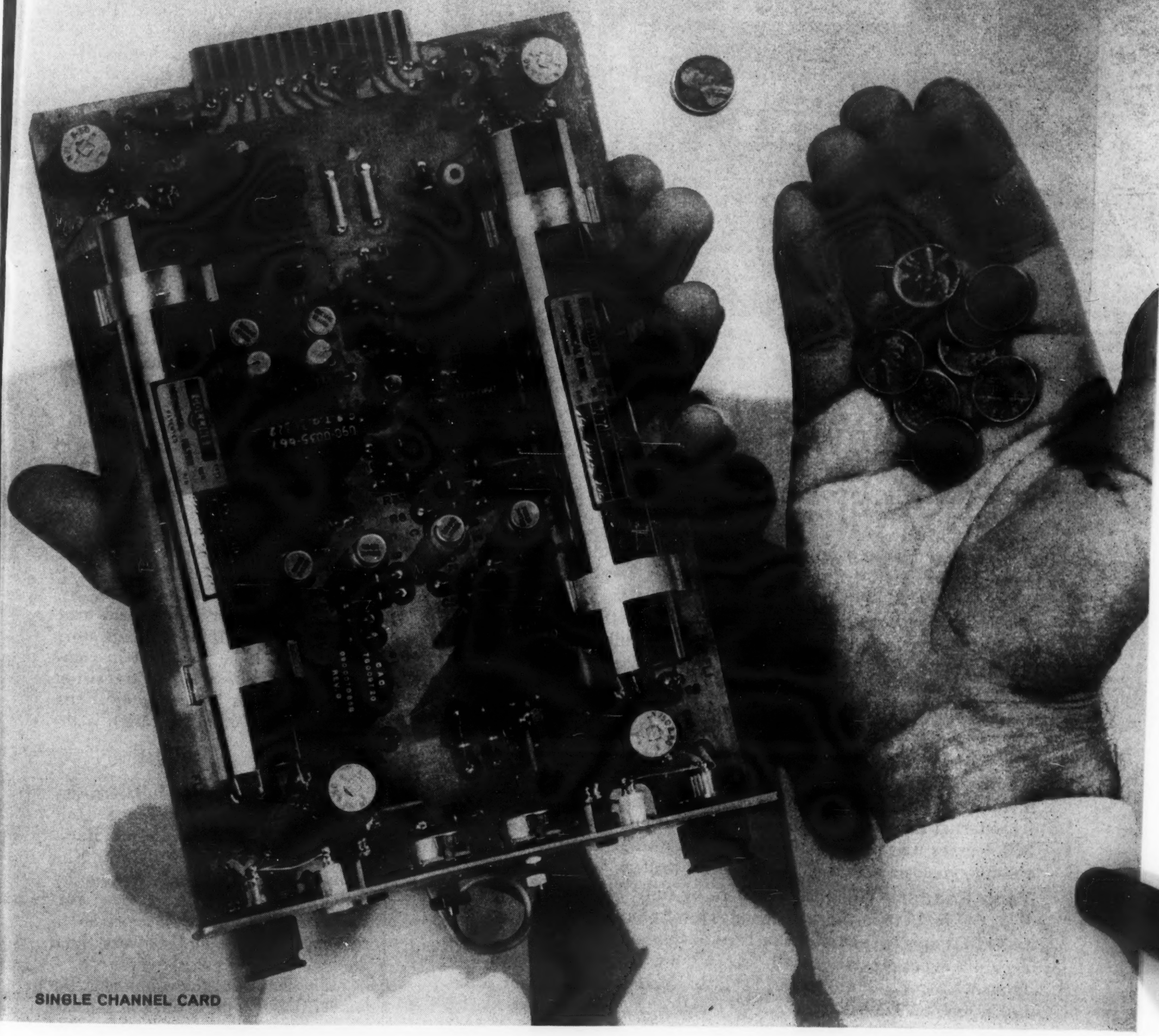
A microminiature microwave C-band oscillator, ¾ inches in diameter and ⅜ of an inch long, excluding projections, is now in advanced developmental stage at Trak Microwave Corporation, Tampa, Florida. The oscillator is being developed for both plate pulse and CW service.

Designated the Trak Type 9180, developmental models are now available on a limited basis, the company reports. Since the new microminiature oscillator will make projects possible that were impossible before, Trak wishes to work with electronics companies at the outset of new microwave projects.

The simplicity of the new oscillator is one of the important features. The projection is an RF output connector, Amphenol series 27, which also serves as a simple chassis mount, with lock nuts on the connecter as mounting brackets. For plate pulse service, the oscillator can be built in the 4 KMc to 6 KMc spectrum with a tuning range of an 300 Mc segment of that spectrum.

Peak pulse power is 50 to 100 watts. The CW version can tune any

CUTS POWER COST **90%**... SPACE BY 80%



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Now . . . the freedom of maintenance and reliability inherent in transistorized equipment, at a saving of up to 90% in power and 80% in rack space over tube equipment. This is Collins new MX-106 fully transistorized carrier. Either in microwave, wire or cable systems — or any combination of these — the new multiplex is compatible with Collins MX-103, Western Electric L-Type, CCITT, and other carriers. Its design permits easy and economical expansion to meet changing requirements. For details, write Collins Radio Company, Texas Division Sales, 1930 Hi-Line Dr., Dallas 7, Texas.

COLLINS MICROWAVE AND CARRIER

COLLINS

COLLINS RADIO COMPANY • DALLAS, TEXAS • CEDAR RAPIDS, IOWA • BURBANK, CALIFORNIA

100 Mc segment of the 4.0 to 5.5 KMc spectrum. 5.5 KMc is not the inherent upper limit, the company points out, since the tube, a ceramic planar triode, is capable of 7 KMc. Power output is approximately 5 mw. Present models are developmental and the final design may be somewhat modified.

• • •

Daco Instrument Company, Tillary and Prince Street, Brooklyn 1, N. Y., has designed a microminiature Rotary Indicator. The indicator comes in two sizes, the smallest of which measures .375 inches in diameter by .562 inches long.

Designed to use 100 milliwatts or less where required, the unit weighs only 3.7 grams and can be supplied for any standard voltage to 30V D.C. or A.C. at 400 cps. The unit is also available for 110V operation with an external resistor. Rotation can be up to 60° either CW or CCW. The solenoids operate in a temperature range of —65° to 165°F. and are of rugged construction with jewel bearings and have a standard extended shaft of 1/32 inches in diameter by 3/16 inches long. Other shaft lengths are available.

The indicator which signals by means of a shutter arangement, can be used as a malfunction indicator, annunciator, binary readout in computers, output indicator in transistor circuits and in other applications where a two-position indication is required.

• • •

Availability of a new, fully-transistorized Multiple Coincidence Unit has been announced by Cosmic Radiation Labs, Bellport, New York. The equipment is based on a design by Robert L. Chase of Brookhaven National Laboratory and accepts up to five input signals and delivers three simultaneous output signals.

Main chassis of the equipment, the Model 801, contains three independent fast-slow coincidence circuits and up to five plug-in circuit boards for processing signals from as many as five radiation detectors. Coincidence resolving time is adjustable from 0 to 180 millimicroseconds. The three coincidence circuits — each of which represents a different set of coincidence conditions—can be used to direct data to three separate sections of the analyzer memory, making it possible to study three aspects of a decay scheme at the same time.

• • •

A portable power source, self-contained and capable of providing from

100 KC TO 2 MC

LOW FREQUENCY

ANTENNA COUPLER

LMC-10

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COUPLES ONE ANTENNA TO TEN RECEIVERS

FREQUENCY RESPONSE:	100 kc to 2 mc, flat within ±2 db.
GAIN:	4 db nominal.
NOISE FACTOR:	Better than 7 db.
INTERMODULATION:	The equivalent antenna voltage of an intermodulated signal will be down at least 50 db with respect to the level of either of two equal amplitude signals whose equivalent antenna voltages to produce the intermodulated signal are: 250,000 μv for 70 ohm antenna
HARMONIC DISTORTION:	Less than 1%.
ISOLATION:	Output-to-output: 45 db or better at 2 mc, rising 3 db/octave to 60 db at 100 kc. Input-to-output: Better than 60 db.
INPUT/OUTPUT IMPEDANCE:	Nominally 70 ohms unbalanced.

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World Wide Suppliers of Electronic Communication Equipment

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300 to 600 watts of CW or modulated R.F. microwave power in frequency ranges from 350 Mc to 10.5 KMc, has been developed by the Litton Industries' Electron Tube Division.

Designated Model L-3653, the equipment may be used as an ideal power source for high power testing of microwave components and systems and as the R.F. driver for high power microwave amplifier tubes.

The Model L-3653 includes a modulation coupling transformer. The equipment will accept modulation frequencies from 60 to 5000 cycles, and requires approximately 300 watts into 500 ohms for 100 percent amplitude modulation at full power.

Controls and indicators required to operate the magnetron are mounted on the front panel. A source of 60 cycle power and an R.F. load system are all that are required to complete the system.

• • •

Active components, identified as Metal Interface Amplifiers (MIA), have been developed by staff members of Philco Research Division's Basic Science and Technology Department.

The laboratory development consists of a thin-film sandwich of metal, metal oxide, and metal placed on a germanium substrate. The two metal layers and the semiconductor serve as emitter, base and collector respectively. According to Research Division scientists, the device exhibits high conduction from emitter to base due to a process of quantum mechanical tunnelling through the oxide insulator.

• • •

Waterman Products Co., Philadelphia, has developed a miniature oscilloscope. The new unit, the Primer-Scope, Mark I, applies the principles of miniaturization to oscilloscope manufacture, presenting a simple, small scope adaptable to numerous testing and experimental applications.

The Primer-Scope weighs under six pounds, is 7¼ inches high, 3½ inches wide and 11¼ inches long. The main scope component is a special 3 inch Rayonic cathode ray tube, incorporating an integral magnetic shield to prevent stray or spurious pickups. Accelerating potential is approximately 840 volts, which is optimum for this type of unit.

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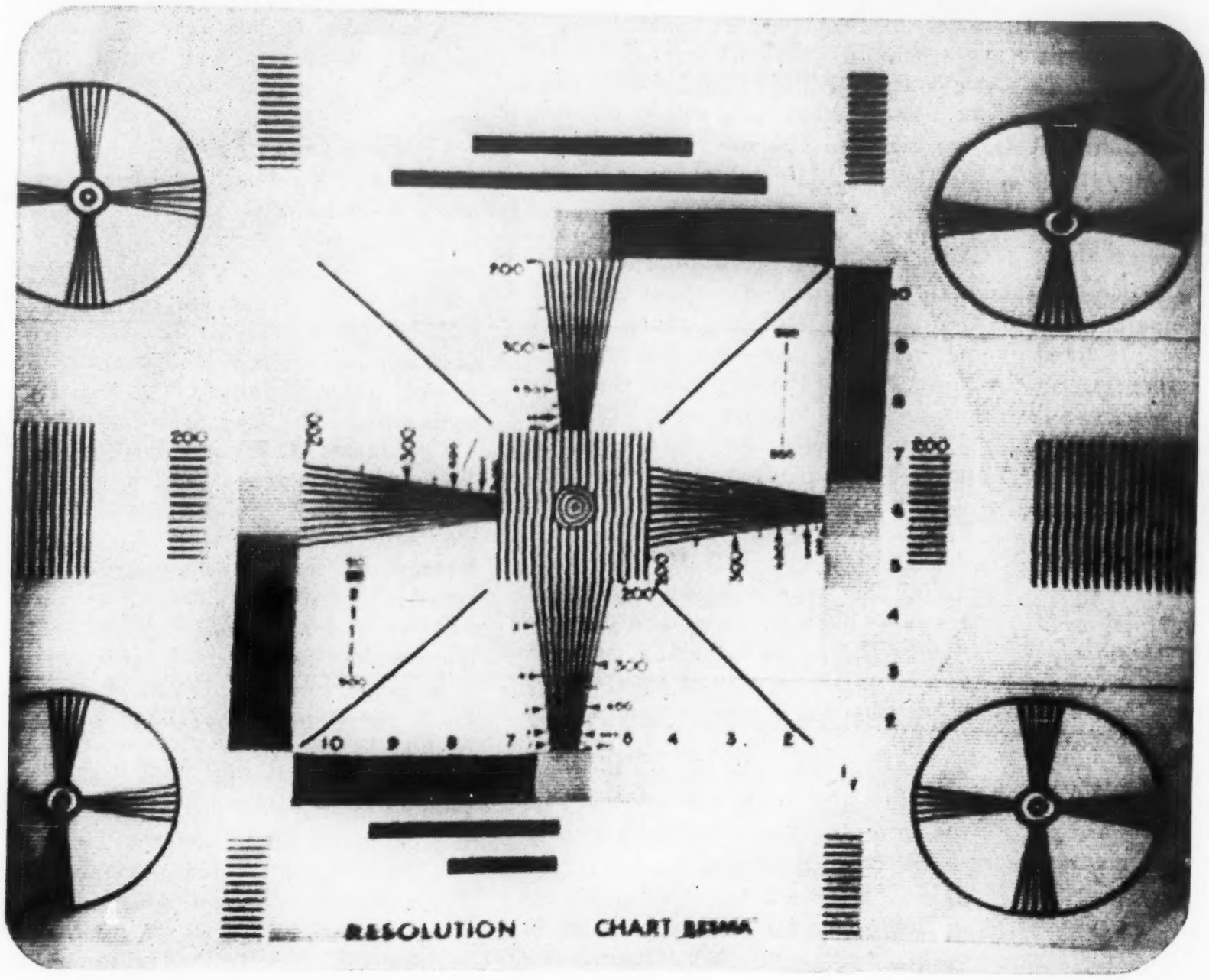
Communication Electronics, Inc., Bethesda, Maryland, is producing a Type 901 Receiver which operates over the frequency range of 30 to

Another First From General Electric



Unretouched photo of TV monitor test pattern shows 600-line resolution accomplished at 1000 cycles, 44 G's vibration with a General Electric super-ruggedized image orthicon selected at random from stock.

Super-Ruggedized Image Orthicons Exceed

600-LINES AT 1000 CYCLES, 44G's

General Electric, which first introduced the Magnesium Oxide thin-film semi-conductor target, now offers a complete line of super-ruggedized image orthicons.

Outstanding performance of new General Electric IO's is the result of a new integral mounting technique recently developed by General Electric engineers.

Initial tests indicate this new technique surpasses all previous methods of ruggedizing image orthicons.

Built to withstand severe vibration conditions encountered in tank, aircraft, missile and space-vehicle applications, the new IO's greatly exceed military specifications of 350-line resolution at 50 to 500 cycles and 5 G's.

Representative samples are evaluated to as high as 1000 cycles, 44 G's vibration.

A complete line of the new IO's is available for immediate delivery. For more information on General Electric super-ruggedized image orthicons, and other special purpose tubes, contact the General Electric Co., Camera Tube Section, Cathode Ray Tube Dept., Building 6, Electronics Park, Syracuse, New York.

265-16-9545-8481-39

CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC

300 mc for AM, FC and CW reception.

Employing new VHF techniques the RF and IF amplifiers utilize ceramic and RCA Nuvistor tubes while the audio, video and auxiliary circuits are transistorized. John F. Whitehead, president of CEI, reports that "to provide maximum stability and dynamic range AGC is applied to both RF and IF amplifiers."

In the lower frequencies the noise figure is 3 db with a maximum of 6½ db over the entire band. IF bandwidths are 300 kc and 20 kc. An audio amplifierd unit with 600-ohm output is provided to operate a separate speaker. There is also provision for connection to a signal monitor display. Panel height is 3½ inches and the entire unit weighs 20 pounds.

• • •

The immediate commercial availability of an eight-watt thermoelectric power generator for industrial field applications has been announced by Texas Instruments Incorporated. The unit contains no moving parts.

The units will operate from natural gas, propane or butane, and are primarily designed for remote unattended field instrumentation. Initial applications are expected to be in the operation of valves on transmission lines or petroleum production facilities and for the cathodic protection of buried or submerged metal. The generator weighs 65 pounds and is 12 inches wide by 17 inches high.

The generators reportedly can be adapted to use any combustible fuel, waste heat and steam or solar heat.

Photoprogress

Tiros II completed six months in orbit on May 23, 1961, and is continuing to transmit useful data, the National Aeronautics and Space Administration has announced. The meteorological satellite was launched November 23, 1960, and at that time had an estimated lifetime of about three months during which it was to provide global weather observations via two television cameras and two experimental infrared sensing systems.

As of May 22, 1961, a total of 31,485 photographs had been transmitted by the two television camera systems. Of these, 78 percent of the 9,488 narrow-angle photographs and 76 percent of the 21,997 wide-angle photographs have been classified as fair to good for meteorological analysis.

While both camera systems continue to operate and to perform at least as well as immediately after launch, one infrared system containing 5 sensors failed on April 23, 1961, after five months of successful operation; the other system has one of its sensors still operating and its other sensor failed only within the last two months. The one remaining sensor that is still operating has only limited use.

During their four to five-month period of useful operation, the IR experiments provided a great mass of unique and useful data which are being reduced, processed and studied. Moreover, all the associated electronics, including the tape recorders, continue to operate. The infrared experiments had no photographic capability.

NASA expects to launch a third Tiros some time this summer. It hopes that the satellite will be operating during the season when hurricanes are most likely to occur and circumstances will be such that TV pictures as well as IR data on at least one of these destructive storms can be obtained. The meteorological data will be furnished to the U. S. Weather Bureau and military services for their use in weather forecasting as well as for research purposes.

• • •

Electronic correlation techniques to solve the task of detecting changes in aerial reconnaissance photography is the subject of a study contract awarded Philco Research Division by Rome Air Development Center, Griffiss AFB, Rome, N. Y. Terrain conditions photographed under varying conditions of light and shadow, at different times of the year, even at different altitudes or angles, are to be compared and correlation sought.

Totalling $61,799, the contract specifies establishment of optimum correlation techniques after investigation of signals received over data-links, as well as photographic information. Also to be investigated are methods of storing reference photographs of an area of interest, information-display and relationship of such variable parameters as scale, dynamic range, resolution and contrast of the photographs being scanned.

• • •

The second annual photo-journalism conference in the West will be presented September 26-29 on California's Monterey Peninsula by the American Society of Magazine Photographers and the University of California Extension.

Keynote speaker will be Edward Steichen, director of photography at the Museum of Modern Art and originator of the exhibit, "The Family of Man."

Names in the News

J. S. Webb, Jr., has been appointed assistant to the president, New Enterprises, Thompson Ramo Wooldridge Inc.

Esterly C. Page has been elected chairman of the board of Page Communications Engineers, Inc. **Joseph A. Waldschmitt** succeeds him as president.

Richard G. Weber has been appointed regional planning manager of the newly formed Washington office of Cutler-Hammer's Airborne Instruments Laboratory division.

Col. James H. Weiner has been assigned commander of the Pacific Airways and Air Communications Service Area. He succeeds **Brig. Gen. Bernard M. Wooton** who retires from the Air Force.

Thomas J. Watson, Jr. has been elected chairman of the board of International Business Machines Corp. He is succeeded as president by **Albert L. Williams.**

Allen J. Lovenstein has been appointed manager of the Advent satellite communications program at the Waltham Laboratories of Sylvania Electronic Systems, a division of Sylvania Electric Products Inc.

Robert L. Plouffe has joined Stelma, Inc. as vice president, director of engineering.

Col. Robert C. Walton, USMC (Ret.), has been appointed head of the West Coast office of Radio Engineering Laboratories, Inc.

Robert J. Brown has been appointed general manager of General Electric's Heavy Military Electronics Department.

Col. Winfield L. Martin has been assigned Signal Officer, Headquarters U.S. Continental Army Command, Fort Monroe, Virginia.

Warren H. Chase has been elected 1961-62 president of the American Institute of Electrical Engineers.

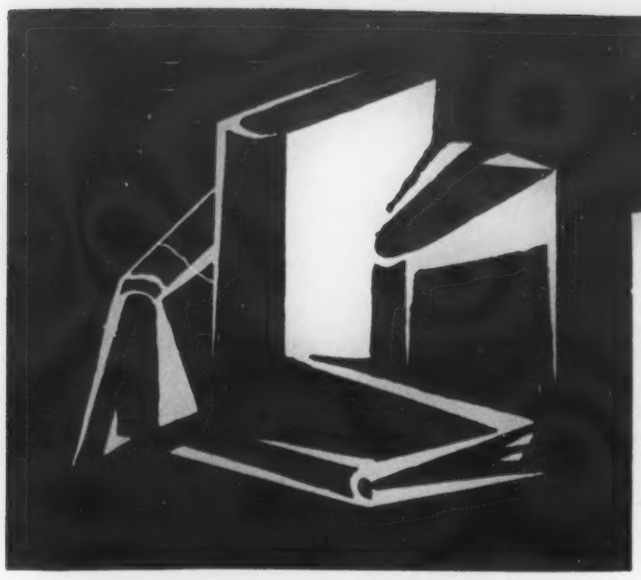
Brig. Gen. Benjamin H. Pochyla has been assigned to the Office, Joint Chiefs of Staff, Washington, D. C.

Brig. Gen. Richard J. Meyer has been assigned Commanding General, U. S. Army Signal Training Center, Ft. Gordon, Georgia.

J. McWilliams Stone, Jr. has been elected executive vice president of DuKane Corp.

Herbert H. Rosen is vice president of Brubaker Inc., Los Angeles, Calif.

Lt. Gen. Clovis E. Byers, USA (Ret.) is vice president, General Telephone and Electric Corp. He succeeds **Adm. Frederick J. Bell**, USA (Ret.) who is now a consultant for the company.



Books

FIELDS OF GLORY, a narrative of American Land Warfare, by Wm. H. Nelson & Frank E. Vandiver. E. P. Dutton & Co., Inc., 300 Fourth Ave., N. Y. 10, N. Y. 316 pages, $10.00.

This compact history covers American land warfare from King Philip's War through the Korean conflict. To supplement the text, there are 16 maps of campaigns and battles and over 300 magnificent illustrations.

The authors have presented their material by the nature of the conflicts. The first section is devoted to wars of "Liberty and Union," and covers the colonial wars, the Revolution, the War of 1812, the War for Texan independence and the Civil War. The next section, "The Trail of Tears," deals with the Indian wars and contains facts about Indian fighting techniques and about American frontiersmen as Indian fighters. The Mexican War, the Spanish-American War and the Mexican Punitive Expedition of 1916-17 are described and analyzed in the section called, "The Halls of Montezuma." "The Yanks are Coming," describes the trench warfare of World War I and the European theatre of World War II, including background material on the rise of Hitler and Mussolini.

The final section traces the history of America's military activities in "The Far East"—Rogers in Korea in 1871; Dewey in Manila; the annexation of the Philippines; the Boxer Rebellion; Japan's aggression in the Pacific; the bombing of Pearl Harbor and subsequent Japanese victories; and, the Korean War.

SEMICONDUCTORS AND TRANSISTORS, by Alexander Schure. Rider Publications, 116 W. 14th St., N. Y. 11, N. Y. 144 pages. Soft cover, $2.90.

The theory and characteristics of semiconductors and transistors are discussed and evaluated. Specific attention is given to atomic structure, the quantum theory, conductors, insulators and semiconductors. Conduction by holes, semiconductors with impurities, and the semiconductor rectifier are analyzed. The p-n junction under equilibrium conditions and in reverse and forward bias, diode tubes (including photodiodes) and an extension of p-n junction theory into the transistor received specific attention. Through these and other detailed topics, a foundation is provided upon which more advanced concepts can be built. Review questions are included at the end of each chapter.

LECTURES ON COMMUNICATION SYSTEM THEORY, edited by Elie J. Baghdady. McGraw-Hill Book Co., Inc., 330 W. 42nd Street, N. Y. 36, 1961. 617 pages, $12.50.

Purpose of this book is to stimulate the development of modern approaches to the design and evaluation of new communication systems by defining a skeleton for the needed discipline and discussing most of the major unsolved problems.

Discussions are theoretical, with emphasis on methods of applying mathematical models and techniques to the design, analysis and evaluation of reliable systems. Each chapter is written by a recognized authority. Outline of the book is centered on an over-all consideration of the reliable-communication problem in which the transmission medium is treated as an integral part of the system.

The author is with the Department of Electrical Engineering, Massachusetts Institute of Technology.

WHITE ENSIGN, The British Navy at War 1939-1945, by Captain S. W. Roskill, Royal Navy. U. S. Naval Institute, Annapolis, Md., 1960. 480 pages, $4.50.

Immediately upon conclusion of World War II, the U. S. Naval Institute embarked upon a project to provide a history of the naval war, told by leading native historians of each of the naval powers engaged, allied or enemy.

The author of this latest history in the series is recognized as one of Britain's ablest historians. He served as executive officer of the battleship *Warspite* in the Mediterranean in 1939; was appointed to the Naval Staff at the Admiralty, where he served for two years before going to command the cruiser *Leander* in the Pacific shortly before Pearl Harbor. When that ship was badly damaged in battle, he was made a member of the British Naval Mission in Washington. He was subsequently Senior British Observer at the Bikini Atomic Bomb Trials in 1946, and then Deputy Director of Naval Intelligence until 1948. Since then he has been Official British Naval Historian.

CAMPAIGN IN THE MARIANAS, by Philip A. Crowl. 50th volume published in the series* U. S. Army in W. W. II *by Office of the Chief of Military History, Department of the Army, Washington 25, D. C. 505 pages, $6.50.

The book tells the story of the capture of Saipan, Tinian, and Guam in mid-1944, together with the strategic and tactical planning that preceded the fighting, the supporting operations by air and sea forces, and the final exploitation of these islands as bases.

The author is a Navy veteran of the Pacific fighting. He commanded an LCI gunboat in action at Leyte Gulf, Lingayen Gulf and Okinawa.

HITLER CONFRONTS ENGLAND, by Walter Ansel. Duke University Press, College Station, Box 6697, Durham, N. C., 1960. 348 pages, $7.50.

Adolf Hitler lost the initiative and eventually the War when he failed to invade England, according to Rear Admiral Walter Ansel, USN (Ret.), former Forrestal Fellow at the U. S. Naval Academy.

This book treats the question of why Hitler did not invade England when the invasion force was primed and eager to go along two distinct but related lines: a running evaluation of the German leadership and the command relationships that the leadership imposed, and along the line of an examination of the German invasion capability.

ELIMINATING MAN-MADE INTERFERENCE, by Jack Darr. Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind., 1960. 160 pages, $2.95.

Twelve chapters cover the field of man-made interference—what it is, how it is transmitted, how it orginates, how to track it to a source, and how to eliminate or minimize its effects in home radios and TV's, audio amplifiers, two-way mobile radio systems, auto, aircraft and marine radios, electromechanical apparatus, geophysical equipment and so forth.

Among the 173 illustrations are photographs of many types of interference as they appear on TV screens. Other illustrations show how to build a noise filter, and how to eliminate noise from small AC motors.

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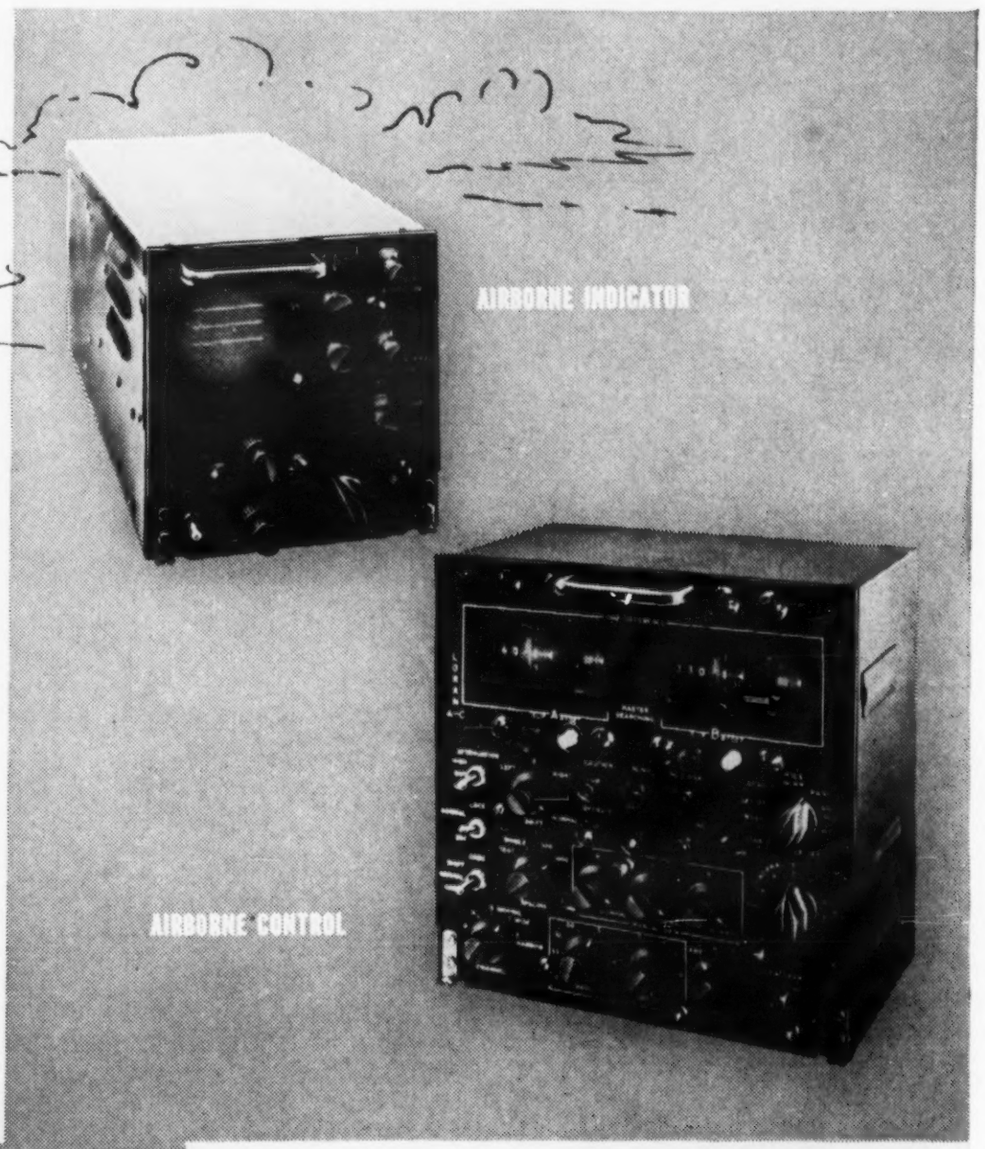
LORAN-C RECEIVERS | NOW IN PRODUCTION



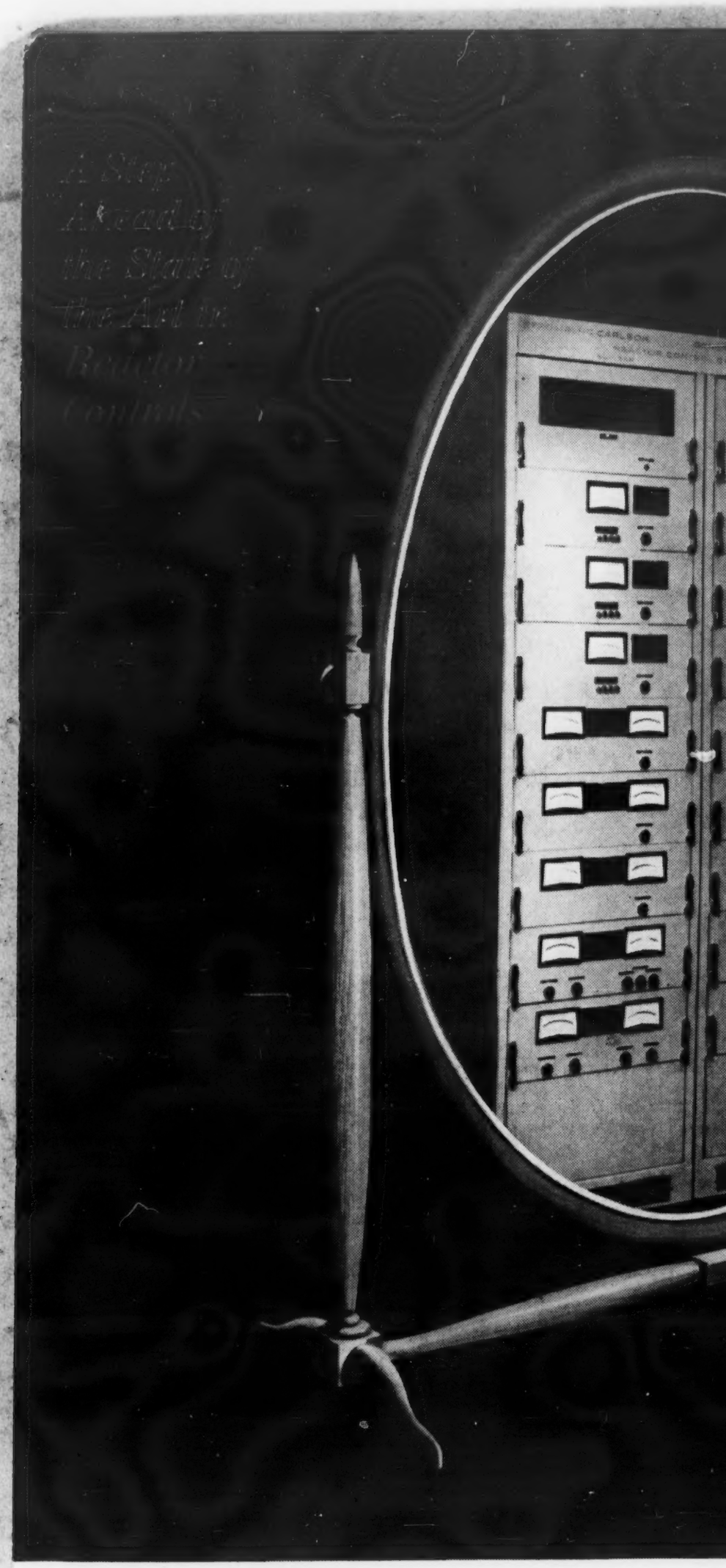
Airborne

Sperry now offers airborne Loran-C receivers—the only airborne systems in production today. Providing extremely accurate position determination—by measurement of the interval between radio pulses from "master" and "slave" Loran stations—these receivers will contribute importantly to advances in air traffic control and navigation, early warning, air-sea rescue, test range instrumentation, mapping and surveying, and many other applications. The rugged, lightweight, automatic direct-reading system consists of a control unit and indicator at the control station, plus a synchronizer unit in a remote location, providing installation flexibility.

Shipboard

Now in production, Sperry's shipboard automatic direct-reading Loran-C receivers offer the finest and most accurate system of long range marine navigation. Other applications include all those shown for the airborne receivers above, as well as picket ships, underwater cable installation and other specialized tasks. Both the airborne and shipboard systems are ready to go to work with the established and growing Coast Guard network of Loran-C transmitting stations. Both are designed to meet specifications of both Bureau of Naval Weapons and Bureau of Ships.

AIR ARMAMENT DIVISION, *SPERRY GYROSCOPE COMPANY · DIVISION OF SPERRY RAND CORPORATION, GREAT NECK, N.Y.*



Introspective

A rigid, continuous self-examination is one of the reasons
General Dynamics/Electronics solid-state, modularized control
tems can squeeze more hours of power from nuclear reactor
and are helping close the dollar gap between the atom and fo
fuels as a source of power.

While attending to their main functions—monitoring and contro
power level, rate of change of power level, pressure, temperat
and coolant flow—General Dynamics/Electronics control sys
check themselves continuously. Should the suspicion of an i
ularity occur, scram rods drop and the address of the malfun
is flashed on the annunciator. In a matter of minutes, an ope
can pull the offending module and plug in a replacement. S

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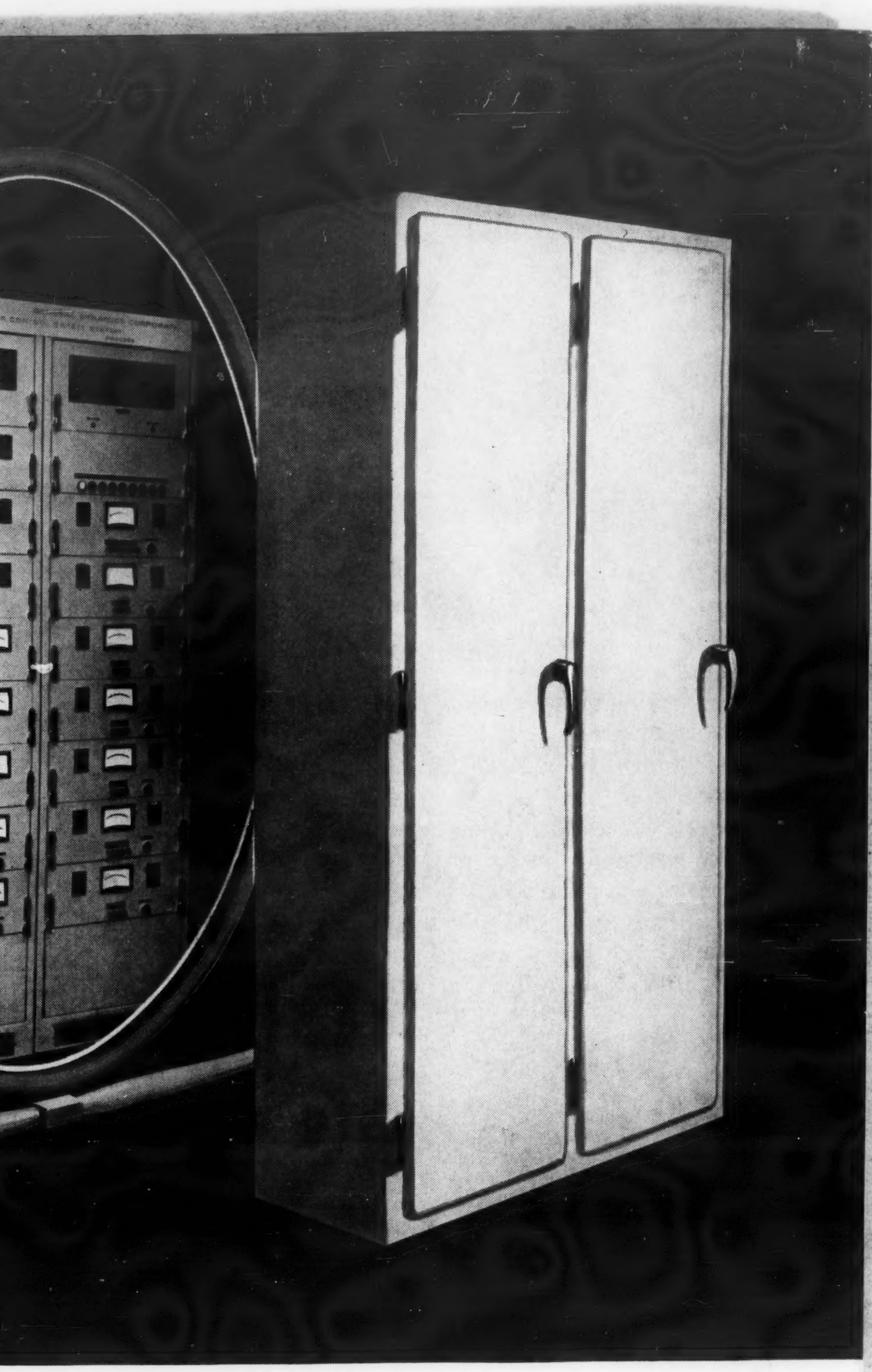
GENERAL DYNA



tive Control System

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controlling emperatures rol systems of an irreg- malfunction an operator ment. Since

this down time was previously measured in hours, the extra time goes into kilowatts.

The dependability factor adds even more hours of power a month. Up to now, lack of reliability in control systems resulted in costly periods of inactivity for system and reactor both. General Dynamics/Electronics control equipment slashed that down time with a new plateau of fail safe operation, achieved through 100% use of transistors and key-point use of solid-state relays.

If you're concerned with nuclear power—marine, portable, research, or commercial—and would like further information, write:

Information Technology Division, 100 Carlson Rd., Rochester 1, N.Y.

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